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Volume 1: Alternatives Evaluation Report

Master Water Control Manual

MISSOURI RIVER

Review and Update

July 1994

Missouri River Master Water Control Manual
Review and Update Study

Volume 1:	Alternatives Evaluation Report
Volume 2:	Reservoir Regulation Studies Long Range Study Model
Volume 3A:	Low Flow Studies Gavins Point Dam to St. Louis, Missouri
Volume 3B:	Low Flow Studies Gavins Point Dam to St. Louis, Missouri • Appendix A - Ice Impacts • Appendix B - Water Quality Impacts
Volume 4:	Hydraulic Studies Upstream from Gavins Point Dam
Volume 5:	Aggradation, Degradation, and Water Quality Conditions
Volume 6A:	Economic Studies Navigation Economics
Volume 6B:	Economic Studies Water Supply Economics
Volume 6C:	Economic Studies Recreation Economics
Volume 6D:	Economic Studies • Hydropower Economics • Flood Control Economics • Mississippi River Economics
Volume 6E:	Economic Studies Regional Economics
Volume 7A:	Environmental Studies Reservoir Fisheries • Main Report • Appendix A - Description of Resource • Appendix B - Reservoir Fish Reproduction Impact Methodology
Volume 7B:	Environmental Studies Reservoir Fisheries • Appendix C - Coldwater Habitat Model
Volume 7C:	Environmental Studies Riverine Fisheries • Main Report • Appendix A - Description of Resource
Volume 7D:	Environmental Studies Riverine Fisheries • Appendix B - Physical Habitat Analysis Upstream of Sioux City • Appendix C - Physical Habitat Analysis Downstream of Sioux City
Volume 7E:	Environmental Studies Riverine Fisheries • Appendix D - Assessing Temperature Effects on Habitat
Volume 7F:	Environmental Studies Wetland and Riparian • Main Report • Appendix A - Field and Mapping Methods • Appendix B - Plant and Wildlife Species List
Volume 7G:	Environmental Studies Wetland and Riparian • Appendix C - Fate of Wetland/Riparian Types • Appendix D - Diversity • Appendix E - Backwater Analyses • Appendix F - Value Function Testing
Volume 7H:	Environmental Studies • Least Tern and Piping Plover • Historic Properties • Mississippi River Environment
Volume 8:	Economic Impacts Model Environmental Impacts Model
Volume 9:	Socioeconomic Studies

Missouri River Master Water Control Manual
Review and Update Study

Overview Discussion on the Reports that Were Prepared Summarizing the Supporting Technical Analyses for the Study

The Environmental Impact Statement (EIS) that was prepared for the Missouri River Master Water Control Manual Review and Update Study contains data that were generated by three primary models: (1) the Long Range Study (LRS) Model that computed the hydrology and other necessary data for subsequent analyses, 2) the Economic Impacts Model that computed the economic effects of the various alternatives, and 3) the Environmental Impacts Model that computed the environmental effects of the various alternatives. Numerous studies were conducted to provide the inputs to these models that allowed them to compute the effects of the alternatives. Detailed information on the development of the three models and their output was documented in reports prepared throughout the study. These reports were reproduced as technical reports supporting the EIS.

The inside cover of this document contains a listing of these technical reports. These reports are numbered from Volume 1 through Volume 9. The following synopses provide a brief overview of the volumes.

Volume 1	Contains output data from the three models on the array of alternatives considered for the draft EIS. It also discusses the data and the results of the analyses of these data.
Volume 2	Provides information on the LRS Model and summarizes some of the analyses that were done on the output data to demonstrate the model's capabilities and data analysis.
Volume 3	Consists of three reports reproduced in two separately bound volumes that summarize the results of analyses to determine the low-flow requirements for the uses relying on the Missouri River downstream from Gavins Point Dam.
Volume 4	Summarizes the hydraulic studies conducted on the river reaches upstream from Gavins Point Dam where daily peaking of the hydropower generators results in stage fluctuations throughout the day.
Volume 5	Contains a compilation of existing data on Missouri River aggradation, degradation, and water quality.

Volume 6	Consists of five separately bound volumes that summarize the data acquisition efforts, the analysis of these data to develop the various parts of the Economic Impacts Model, and the economic effects of some of the alternatives. The last of these bound volumes (Volume 6E) summarizes the Missouri River basin Multi-Regional Input-Output (MRIO) Model that was used to compute the total regional economic effects of some of the alternatives using output from the Economic Impacts Model.
Volume 7	Consists of eight separately bound volumes (19 documents) that summarize the data acquisition efforts, the analysis of these data, and the development of numerous computer models. These models computed the relationships used in the Environmental Impacts Model and provided the results of the model runs for some of the resources evaluated.
Volume 8	Consists of two reports: one on the Economic Impacts Model and one on the Environmental Impacts Model. These two reports provide some insight as to how the models are set up and how they work.
Volume 9	Summarizes background socioeconomic data on various subregions in the United States and provides more detailed information on the subregions within the Missouri River basin. This volume also summarizes the results of the socioeconomic analysis of a small sample set of alternatives from the large array of alternatives considered for the draft EIS.

Readers of the EIS are referred to these technical reports for details on the studies that were conducted in support of the EIS. These documents are referenced in the EIS whenever the information or data being presented is supported by these technical reports. A variety of organizations prepared these reports and their different formats reflect this diversity. Also, these reports are intended for a technically-oriented audience rather than the public.

At the front of each of these reports is a brief summary of the content of the report containing more detail than provided above. This summary is to help in selecting the appropriate report from the numerous volumes listed.

Missouri River Master Water Control Manual

Review and Update Study

Volume 1: Alternatives Evaluation Report

U.S. Army Corps
of Engineers
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Alternatives Evaluation Report

Missouri River Master Water Control Manual

Review and Update Study

Volume 1: Alternatives Evaluation Report

This Alternatives Evaluation Report (AER) is a supporting document to the Draft Environmental Impact Statement (DEIS) for the Review and Update Study for the Missouri River Mainstem System Master Water Control Manual (Master Manual). Modeling results for alternative operating regimes to the current Water Control Plan are presented for comparison. Changes were evaluated in the following features of the current Water Control Plan:

- Navigation service criteria (service level and season length) in drought periods
- Intrasystem regulation of water in storage
- Nonnavigation service levels (winter, spring/fall, and summer seasons)
- A spring rise in river flow through higher spring service levels
- Flood control constraints on system water releases
- Navigation season length in nondrought periods
- Permanent pool level

Results are presented for 383 alternative configurations of the current water control plan. These alternatives include various combinations of the seven features listed above. Results are presented for the following resource categories:

- System hydrology (lake levels and river flows)
- Wetland habitat
- Riparian habitat
- Tern and plover nesting habitat
- Young fish production in mainstem lakes
- Lake coldwater fish habitat
- River coldwater fish habitat
- River warmwater fish habitat
- Native river fish physical habitat
- Flood control
- Water supply
- Hydropower
- Recreation
- Navigation
- Historic properties

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1.0 INTRODUCTION

This Alternatives Evaluation Report is a supporting document to the Draft Environmental Impact Statement (DEIS) for the Review and Update Study for the Missouri River Mainstem System Master Water Control Manual (Master Manual). This report documents the results of the analyses of potential changes in the Master Manual. These Master Manual changes are addressed in the DEIS. A summary of these results is presented in Chapter 4 of the DEIS. Chapter 2.0 describes the plan evaluation process and the tools used to evaluate the hydrologic, economic, and environmental performance of the alternatives evaluated. Chapters 3.0 through 16.0 describe the effects on system hydrology, and key environmental and economic resources for the final set of alternatives evaluated in the DEIS.

A set of 383 alternatives was developed to evaluate potential changes in the Master Manual. The evaluation focuses on changes to five system operating features:

(1) permanent pool level of the six mainstem lakes;
(2) storage release criteria for minimum navigation service (navigation criteria);
(3) storage release criteria for minimum nonnavigation service;
(4) balance of water in storage among the upper three mainstem lakes; and
(5) flood control constraints on storage releases.

The Basic Set of 274 alternatives is described via a six-digit identification system:

First digit: minimum permanent pool (A to E and G) (18, 26, 31, 38, 44, and 48 MAF)
Second digit: winter minimum nonnavigation service level (A to D) (9, 12, 15, and 18 kcfs)
Third digit: spring/fall minimum nonnavigation service level (A to E) (9, 12, 15, 18, and 25 kcfs)
Fourth digit: summer minimum nonnavigation service level (A to E) (9, 12, 15, 18, and 25 kcfs)
Fifth digit: navigation criteria (1 or 2)
  1 = current criteria
  2 = modified criteria
Sixth digit: intrasystem regulation (0 or 1)
  0 = current regulation (balanced)
  1 = modified regulation (unbalanced)

The current Water Control Plan has an identification code of ABAA10. Alternative ABAA11 is provided to portray the effects of modified intrasystem regulation. Alternative ABAA20 is provided to represent the effects of a modified set of navigation criteria.

The Basic Set of alternatives (274) has varying permanent pools and nonnavigation service levels (Table 1-1). Permanent pool levels included are 18, 26, 31, 38, 44, and 48 million acre-feet (MAF). Minimum nonnavigation service levels included are 9, 12, 15, and 18 kcfs for winter (December 1 to March 15); 9, 12, 15, 18, and 25 kcfs for spring/fall (March 15 to 31, and October and November); and 9, 12, 15, 18, and 25 kcfs for summer

(April through September). The Basic Set of alternatives also has the modified navigation and intrasystem regulation criteria (Table 1-2).

The Missouri River Natural Resources Committee (MRNRC) and resource managers in Montana, North Dakota, and South Dakota have recommended a modified scheme for allocation of storage among the upper three lakes to enhance fish production. These recommendations include rising or constant water surface elevations during the spring spawning and egg incubation period, management of the upper reservoirs to encourage vegetative growth and to enhance spawning success, minimum pool levels for the protection of critical habitats, and moderations of fall drawdowns to protect benthic production. The modified intrasystem regulation attempts to address some of these recommendations.

The modified intrasystem regulation occurs over a 3-year cycle. The first year provides rising spring water levels in Fort Peck Lake and Lake Sakakawea by reducing normal April through June discharges from the two lakes by one-half. Lake Oahe thus undergoes a drawdown. In the second year, Garrison Dam releases 10 kcfs more than Oahe from April through June, thus providing rising water levels in Lake Oahe and a drawdown in Lake Sakakawea. In the third year, Lake Sakakawea undergoes spring filling by reducing normal April through June releases from Garrison Dam by 5 kcfs, while raising Fort Peck releases to 9 kcfs in April, 10 kcfs in May, and 22 kcfs in June. Fort Peck Lake and Lake Oahe undergo a drawdown in the third year.

In addition to the Basic Set of alternatives, 105 Native Fish alternatives were included with varying permanent pool levels, navigation season lengths (6 and 8 months), provisions for higher spring flows with higher spring navigation service levels, and varying flood-control constraints (Table 1-3). All have the modified navigation criteria and intrasystem regulation, and the minimum nonnavigation service level designation BAE. Tern and plover constraints are not included in these alternatives, because spring flows are set sufficiently high to discourage nesting at lower elevations on river bars and islands.

In addition to the above alternatives, an alternative called EVQ2 was modeled as a theoretical environmental maximum. EVQ2 portrays project operation in a run-of-river mode, with no active storage and no flood control zones. Essentially, reservoir inflows equal reservoir outflows on a monthly basis.

Table 1-1. The Basic Set of alternatives developed for evaluation in the DEIS.[a/]

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						Nonnavigation Service Level		
Permanent Pool (MAF)						Winter	Spring/Fall	Summer
18	26	31	38	44	48	(kcfs)	(kcfs)	(kcfs)
AAAA	BAAA	CAAA	DAAA	EAAA	GAAA	9	9	9
AAAB	BAAB	CAAB	DAAB	EAAB	GAAB	9	9	12
AAAC	BAAC	CAAC	DAAC	EAAC	GAAC	9	9	15
AAAD	BAAD	CAAD	DAAD	EAAD	GAAD	9	9	18
AAAE	BAAE	CAAE	DAAE	EAAE	GAAE	9	9	25
---	---	---	---	---	---	9	12	9
AABB	BABB	CABB	DABB	EABB	GABB	9	12	12
AABC	BABC	CABC	DABC	EABC	GABC	9	12	15
AABD	BABD	CABD	DABD	EABD	GABD	9	12	18
AABE	BABE	CABE	DABE	EABE	**	9	12	25
---	---	---	---	---	---	9	15	9,12
AACC	BACC	CACC	DACC	EACC	GACC	9	15	15
AACD	BACD	CACD	DACD	EACD	GACD	9	15	18
AACE	BACE	CACE	DACE	**	**	9	15	25
---	---	---	---	---	---	9	18,25	9,12,15
AADD	BADD	CADD	DADD	EADD	**	9	18	18
AADE	BADE	CADE	**	**	**	9	18	25
---	---	---	---	---	---	9	25	18
AAEE	**	**	**	**	**	9	25	25
ABAA	BBAA	CBAA	DBAA	EBAA	GBAA	12	9	9
ABAB	BBAB	CBAB	DBAB	EBAB	GBAB	12	9	12
ABAC	BBAC	CBAC	DBAC	EBAC	GBAC	12	9	15
ABAD	BBAD	CBAD	DBAD	EBAD	GBAD	12	9	18
ABAE	BBAE	CBAE	DBAE	EBAE	**	12	9	25
---	---	---	---	---	---	12	12	9
ABBB	BBBB	CBBB	DBBB	EBBB	GBBB	12	12	12
ABBC	BBBC	CBBC	DBBC	EBBC	GBBC	12	12	15
ABBD	BBBD	CBBD	DBBD	EBBD	GBBD	12	12	18
ABBE	BBBE	CBBE	DBBE	**	**	12	12	25
---	---	---	---	---	---	12	15	9,12
ABCC	BBCC	CBCC	DBCC	EBCC	GBCC	12	15	15
ABCD	BBCD	CBCD	DBCD	EBCD	---	12	15	18
ABCE	BBCE	CBCE	---	---	---	12	25	9 - 15
ABDD	BBDD	CBDD	DBDD	**	**	12	25	18
ABDE	BBDE	CBDE	**	**	**	12	25	25
ACAA	BCAA	CCAA	DCAA	ECAA	GCAA	15	9	9
ACAB	BCAB	CCAB	DCAB	ECAB	GCAB	15	9	12
ACAC	BCAC	CCAC	DCAC	ECAC	GCAC	15	9	15
ACAD	BCAD	CCAD	DCAD	ECAD	GCAD	15	9	18
ACAE	BCAE	CCAE	DCAE	**	**	15	9	25
---	---	---	---	---	---	15	12	9
ACBB	BCBB	CCBB	DCBB	ECBB	GCBB	15	12	12
ACBC	BCBC	CCBC	DCBC	ECBC	**	15	12	15
ACBD	BCBD	CCBD	DCBD	ECBD	**	15	12	18
ACBE	BCBE	CCBE	DCBE	**	**	15	12	25

Table 1-1. The Basic Set of alternatives developed for evaluation in the DEIS.[a/]

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Permanent Pool (MAF)						Nonnavigation Service Level		
						Winter	Spring/Fall	Summer
18	26	31	38	44	48	(kcfs)	(kcfs)	(kcfs)
---	---	---	---	---	---	15	15	9,12
ACCC	BCCC	CCCC	DCCC	ECCC	**	15	15	15
ACCD	BCCD	CCCD	DCCD	ECCD	**	15	15	18
ACCE	BCCE	CCCE	**	**	**	15	15	25
---	---	---	---	---	---	15	18	9,12,15
ACDD	BCDD	CCDD	DCDD	**	**	15	18	18
ACDE	BCDE	**	**	**	**	15	18	25
---	---	---	---	---	---	15	25	9 - 18
**	**	**	**	**	**	15	25	25
ADAA	BDAA	CDAA	DDAA	EDAA	GDAA	18	9	9
ADAB	BDAB	CDAB	DDAB	EDAB	**	18	9	12
ADAC	BDAC	CDAC	DDAC	EDAC	**	18	9	15
ADAD	BDAD	CDAD	DDAD	**	**	18	9	18
ADAE	BDAE	CDAE	DDAE	**	**	18	9	25
---	---	---	---	---	---	18	12	9
ADBB	BDBB	CDBB	DDBB	EDBB	**	18	12	12
ADBC	BDBC	CDBC	DDBC	EDBC	**	18	12	15
ADBD	BDBD	CDBD	DDBD	EDBD	**	18	12	18
ADBE	BDBE	CDBE	**	**	**	18	12	25
---	---	---	---	---	---	18	15	9,12
ADCC	BDCC	CDCC	DDCC	EDCC	**	18	15	15
ADCD	BDCD	CDCD	DDCD	**	**	18	15	18
ADCE	BDCE	**	**	**	**	18	15	25
---	---	---	---	---	---	18	18	9,12,15
ADDD	BDDD	CDDD	**	**	**	18	18	18
ADDE	**	**	**	**	**	18	18	25
---	---	---	---	---	---	18	25	9 - 18
**	**	**	**	**	**	18	25	25
---	---	---	---	---	---	18	25	18
**	**	**	**	**	**	18	25	25

** = insufficient storage water

--- = unacceptable alternative (summer nonnavigation service level lower than spring/fall level)

a/ All of the Basic Set of alternatives have a six-digit identification code with 21 as the last two digits [see discussion on modified navigation criteria (2) and modified intrasystem regulation (1)]. The first digit represents permanent pool, the second the minimum winter service level, the third the minimum spring/fall service level, and the fourth the minimum summer service level.

Table 1-2. Existing and modified navigation criteria.

EXISTING NAVIGATION CRITERIA

Service Level March 15 Check		Service Level July 1 Check		Season Length July 1 Check	
Full Service (MAF)	Minimum Service (MAF)	Full Service (MAF)	Minimum Service (MAF)	8-Mo. Season (MAF)	6-Mo. Season (MAF)
54.5	46.0	59.0	50.5	41.0	25.0

MODIFIED NAVIGATION CRITERIA

	Service Level Criteria		Service Level Criteria		Season Length Criteria	
	Mar 15		July 1		July 1	
Permanent Pool (MAF)	Full Svc (MAF)	Min Svc (MAF)	Full Svc (MAF)	Min Svc (MAF)	8 Months (MAF)	6 Months (MAF)
18	57.5	54.5	62.5	60.5	60.0	52.0
26	57.5	54.5	62.5	60.5	60.0	53.0
31	57.5	54.5	62.5	60.5	60.0	54.0
38	57.5	55.0	62.5	60.5	60.0	55.0
44	57.5	56.0	62.5	61.0	60.0	57.5
48	58.5	57.5	64.5	62.5	62.0	60.0

Table 1-3. The Native Fish alternatives developed for evaluation in the DEIS.

Permanent Pool (MAF)					Spring (April - June) Service Level (kcfs)	Flood Control Constraints	Months Navigation is not Supported
18	26	31	38	44			
ABAE31	BBAE31	CBAE31	DBAE31	EBAE31	45	Existing	Unchanged
ABAE32	BBAE32	CBAE32	DBAE32	EBAE32	55	Existing	Unchanged
ABAE33	BBAE33	CBAE33	DBAE33	EBAE33	65	Existing	Unchanged
ABAE41	BBAE41	CBAE41	DBAE41	EBAE41	45	Reduced	Unchanged
ABAE42	BBAE42	CBAE42	DBAE42	EBAE42	55	Reduced	Unchanged
ABAE43	BBAE43	CBAE43	DBAE43	EBAE43	65	Reduced	Unchanged
ABAE51	BBAE51	CBAE51	DBAE51	EBAE51	45	Eliminated	Unchanged
ABAE52	BBAE52	CBAE52	DBAE52	EBAE52	55	Eliminated	Unchanged
ABAE53	BBAE53	CBAE53	DBAE53	EBAE53	65	Eliminated	Unchanged
ABAE61	BBAE61	CBAE61	DBAE61	EBAE61	45	Reduced	Aug/Sept
ABAE62	BBAE62	CBAE62	DBAE62	EBAE62	55	Reduced	Aug/Sept
ABAE63	BBAE63	CBAE63	DBAE63	EBAE63	65	Reduced	Aug/Sept
ABAE71	BBAE71	CBAE71	DBAE71	EBAE71	45	Reduced	Oct/Nov
ABAE72	BBAE72	CBAE72	DBAE72	EBAE72	55	Reduced	Oct/Nov
ABAE73	BBAE73	CBAE73	DBAE73	EBAE73	65	Reduced	Oct/Nov
ABAE81	BBAE81	CBAE81	DBAE81	EBAE81	45	Eliminated	Aug/Sept
ABAE82	BBAE82	CBAE82	DBAE82	EBAE82	55	Eliminated	Aug/Sept
ABAE83	BBAE83	CBAE83	DBAE83	EBAE83	65	Eliminated	Aug/Sept
ABAE91	BBAE91	CBAE91	DBAE91	EBAE91	45	Eliminated	Oct/Nov
ABAE92	BBAE92	CBAE92	DBAE92	EBAE92	55	Eliminated	Oct/Nov
ABAE93	BBAE93	CBAE93	DBAE93	EBAE93	65	Eliminated	Oct/Nov

2.0 PLAN EVALUATION

The water control plan alternatives development process relied heavily on three sets of modeling tools: (1) the Long Range Study (LRS) Model provided the focus of the evaluation through its prediction of hydrological responses to each alternative water control plan; (2) the Economic Impacts Model predicted the economic value accrued from each alternative; and (3) the Environmental Impacts Model provided an assessment of the value of key environmental resources for each alternative.

2.1 LONG RANGE STUDY MODEL

The LRS Model was developed by the Corps to simulate project operations and monthly average lake levels and river flows at representative locations during the historical period of hydrologic record (1898 to 1993). Records of river flows were adjusted to accommodate the present level of development in the Missouri River basin. The model was then calibrated using current operating criteria to compare actual reservoir levels and river discharges with model predictions. Effects on lake levels and river flows from changes in the current Water Control Plan were predicted using the LRS Model. Predictions are in the form of a 96-year record of monthly stored water levels at each reservoir and river flow at key gaging stations from Fort Peck Dam downstream to St. Louis. [For details on the LRS Model see the Long Range Study Model technical report (Corps, 1994a)]. Each alternative has a unique LRS Model output consisting of a 96-year record of monthly reservoir levels and river gage flows.

2.2 ECONOMIC IMPACTS MODEL

The Economic Impacts Model, described in detail in the Economic Impacts Model technical report (Corps, 1994b), was developed to predict the National Economic Development (NED) dollar value for flood control, water supply, navigation, recreation, and hydropower from reservoir level and river flows. Each unique set of monthly data generated by the LRS Model for each alternative invokes mathematical functions that estimate the dollar value associated with each economic resource. These individual values are then added to provide a combined NED dollar value for each alternative. The Economic Impacts Model also estimates Regional Economic Development (RED) dollar values for recreation and navigation.

2.3 ENVIRONMENTAL IMPACTS MODEL

The Environmental Impacts Model, described in detail in the Environmental Impacts Model technical report (Corps, 1994c), was developed to predict the value of certain key environmental resources from the monthly hydrology data generated by the LRS Model. Wetland and riparian habitat acres in lake deltas were estimated from both river flows and lake levels; acres of habitat along river reaches from Fort Peck to St. Louis were estimated from river flows. Acres of nesting habitat of threatened and endangered least terns and piping plovers, two birds that nest on islands in the Missouri River, were estimated from river flow predictions. Fish production in mainstem lakes was estimated from the monthly and yearly sequences of lake water levels and river inflow and outflow provided by the LRS Model. Fish habitat in the river reaches was estimated from river flow predictions. Wave erosion effects on historical sites located in the reservoirs were estimated from LRS Model predictions of lake levels.

2.4 ALTERNATIVES EVALUATION

The following chapters summarize the results of applying the above models on the alternatives described in Chapter 1.0. The evaluations focus on the effects of four sets of factors that are being considered for change in the Water Control Plan:

(1) The effect of a modified navigation and intrasystem regulation criteria;
(2) The effect of nonnavigation service levels;
(3) The effect of the Native Fish Series (higher spring navigation service levels, reduced navigation season lengths and less constraints on service levels for flood control); and
(4) The effect of increasing the permanent pool level.

2.4.1 Effect of Modified Navigation and Intrasystem Regulation Criteria

The evaluation of modified navigation and intrasystem regulation criteria is accomplished through the review of modeling results of four alternatives: ABAA10, ABAA11, ABAA20, and ABAA21. Results are presented in a standard graphical display of the resource value of the four alternatives over the 96-year simulation period (Figure 2-1).

The effect of the modified navigation guide curves is viewed through comparison of alternative ABAA10 versus ABAA20 and ABAA11 versus ABAA21. The effect of the modified intrasystem regulation is viewed by comparing alternatives ABAA10 with ABAA11 and ABAA20 with ABAA21. The overall effect of both factors is evaluated through comparison of Alternative ABAA10 with ABAA21.

2.4.2 Effect of Nonnavigation Service Levels

The evaluation of the effect of varying winter, spring/fall, and summer minimum nonnavigation service levels is accomplished through comparison of modeling results for the Basic Set of 274 alternatives. Results are presented in a standard graphical display depicting the average resource value for each service level by minimum permanent pool level (Figure 2-2).

Because the Basic Set of alternatives is not a complete array of all possible nonnavigation service levels and minimum permanent pool levels (see Table 1-1), the sample size for the average value for specific nonnavigation service levels may vary. For example, note in Figure 2-2 the average depicted for the summer nonnavigation service level E (25 kcfs) for the G permanent pool level (a value of about 63 MAF). Also note in Table 1-1 that only one alternative, GAAE, has a "G" permanent pool level and an "E" summer nonnavigation service level. (Other alternatives with a G-pool and E service level had insufficient storage water.) Therefore, the average depicted in Figure 2-2 represents the "average" or just the one value. In contrast, note that the average value depicted in Figure 2-2 for alternatives with a "G" permanent pool level and a summer nonnavigation service level of "D" (18 kcfs) is made up of the average of six alternatives (see Table 1-1).

Because the mean values depicted in Figure 2-2 are based not only on different sample sizes but differing contributions from nonnavigation service levels of other seasons, care must be taken in interpretation of the differences or trends depicted in nonnavigation service levels. Furthermore, because effects of nonnavigation service levels are concentrated in drought periods, average differences over the 96-years tend to mask drought period effects. For these reasons, a second graphical display type is provided for specific sets of alternatives to depict drought period effects (Figure 2-3).

2.4.3 Effect of Native Fish Series

The effects of higher spring navigation service levels, reduced flood control constraints, and reduced navigation season lengths of the Native Fish Series are evaluated through the review of model results for the 105 Native Fish Alternatives (see Table 1-3). Results are presented in a standard graphical display of the average resource value by series and spring rise (Figure 2-4). Series include the 30, 40, and 50 series, which represent alternatives with full navigation seasons and increasingly reduced flood control constraints. Series 60 and 80 represent 6-month navigation seasons with August and September eliminated at two levels (depicted by 60 or 80) of reduced flood control constraints (see Table 1-3). Series 70 and 90 represent 6-month navigation seasons with October and November eliminated at two levels (depicted as 70 and 90) of reduced flood control constraints. The spring rise in service level is depicted with different symbols for each level of increase (+10, 20, or 30 kcfs).

While Figure 2-4 presents the patterns of average effect over the 96-year simulation period, Figures 2-5 and 2-6 depict more detailed presentation forms. Figure 2-5 depicts values over the 96-year period for the three levels of spring rise in service level. Figure 2-6 depicts the same feature but averaged by month over the 96-year period. These same formats are provided for three levels of flood control constraints and three types of navigation season (40, 60/80, and 70/90).

2.4.4 Effect of Minimum Permanent Pool Level

The effect of increasing the minimum permanent pool level are evaluated by reviewing model results presented for the Basic Set of alternatives (see Figure 2-2) and Native Fish alternatives (see Figure 2-4). In addition, resource values for individual alternatives averaged over the 96-year simulation period are plotted by permanent pool level (Figure 2-7).

Monthly or annual values are also presented for two or more permanent pool levels (Figures 2-8 and 2-9).

2.5 REPORT ORGANIZATION

Chapter 3.0 summarizes system hydrology (lake levels and river flows) results from the LRS Model. Chapter 4.0 describes the effects of changes in hydrology on wetlands and riparian habitats. Chapter 5.0 describes the effects on nesting habitat of threatened and endangered least tern and piping plover. Chapter 6.0 describes the predicted effects on young fish production in the six mainstem lakes. Chapter 7.0 describes the effects on coldwater fish habitat in the mainstem lakes. Chapter 8.0 portrays the effects on coldwater fish habitat downstream of Fort Peck Dam and Garrison Dam. Chapter 9.0 describes the effects on the extent of warmwater fish habitat in reaches below Fort Peck Dam, Garrison Dam, and Oahe Dam. Chapter 10.0 describes the effects on the physical habitat of fish in riverine portions of the Missouri River between Fort Peck Dam and St. Louis. Chapters 11.0 through 15.0 show the effects on NED dollars for hydropower, water supply, flood control, navigation, and recreation. Chapter 16.0 displays the effects on historic properties.

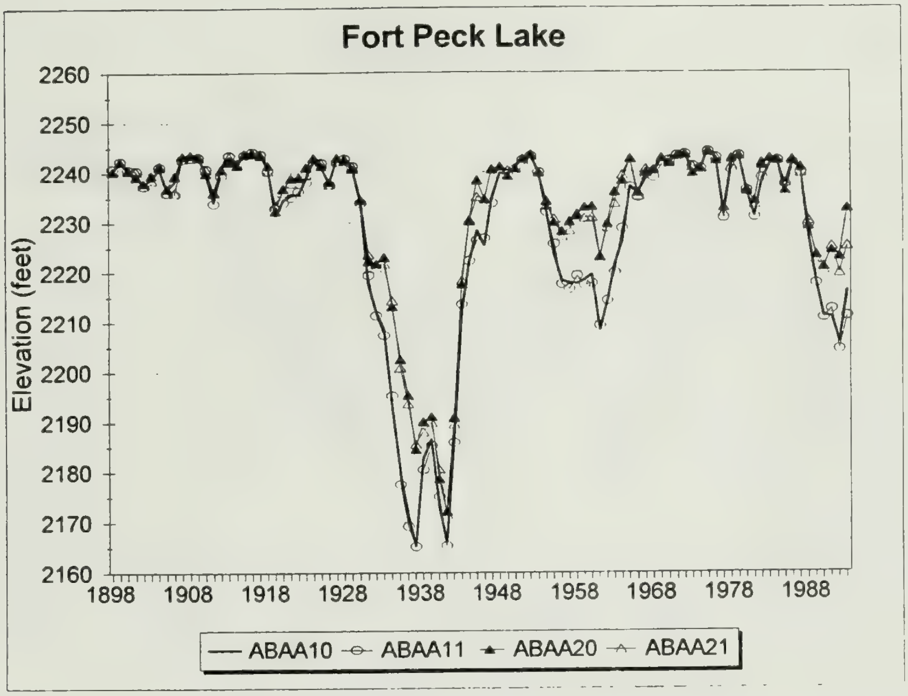

Figure 2-1. Average annual water levels in Fort Peck Lake simulated for four alternatives (1898 to 1993).

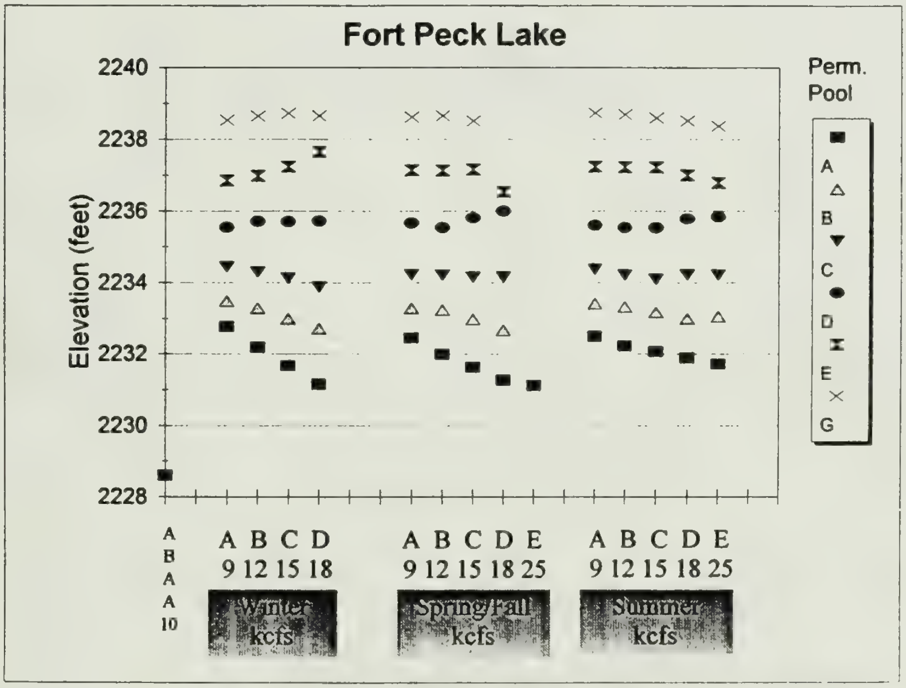

Figure 2-2. Annual average water surface elevation in Fort Peck Lake over the 96-year simulation period by nonnavigation service level.

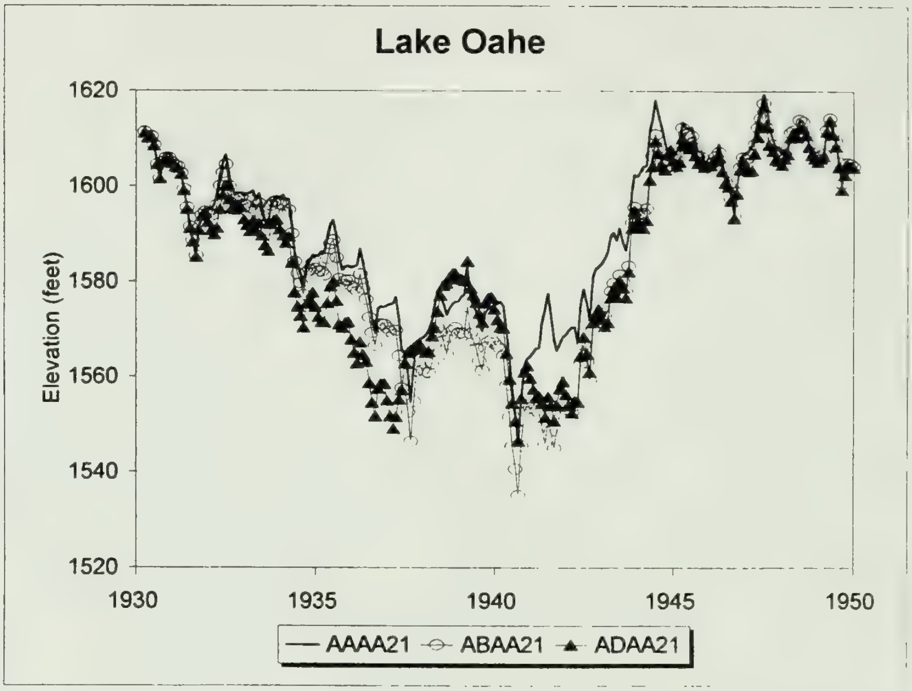

Figure 2-3. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three A-level permanent pool alternatives with different winter nonnavigation service levels.

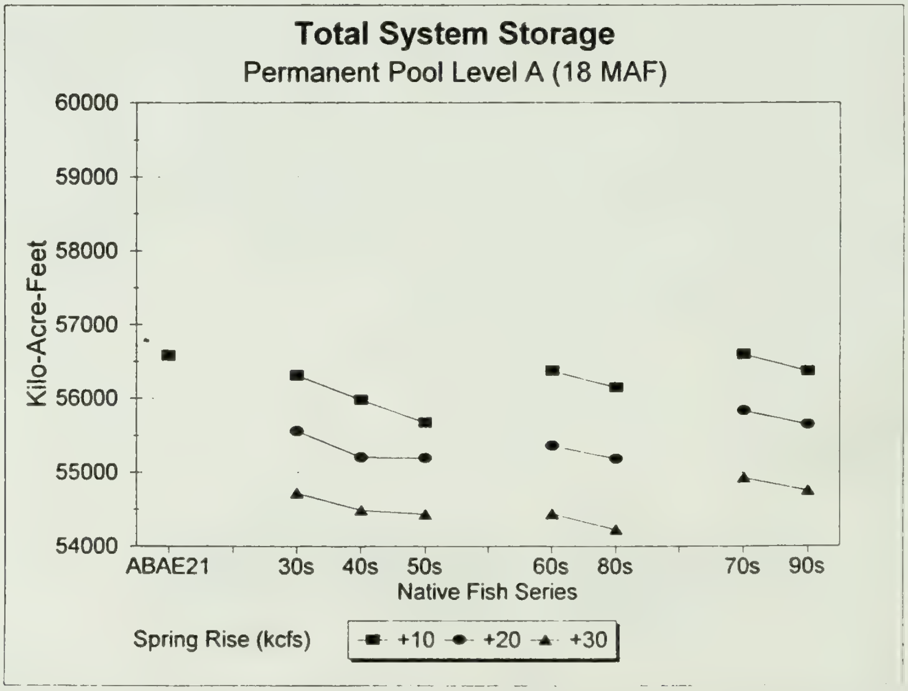

Figure 2-4. Average annual total system storage (KAF) for A-pool Native Fish alternatives over the 96-year simulation period.

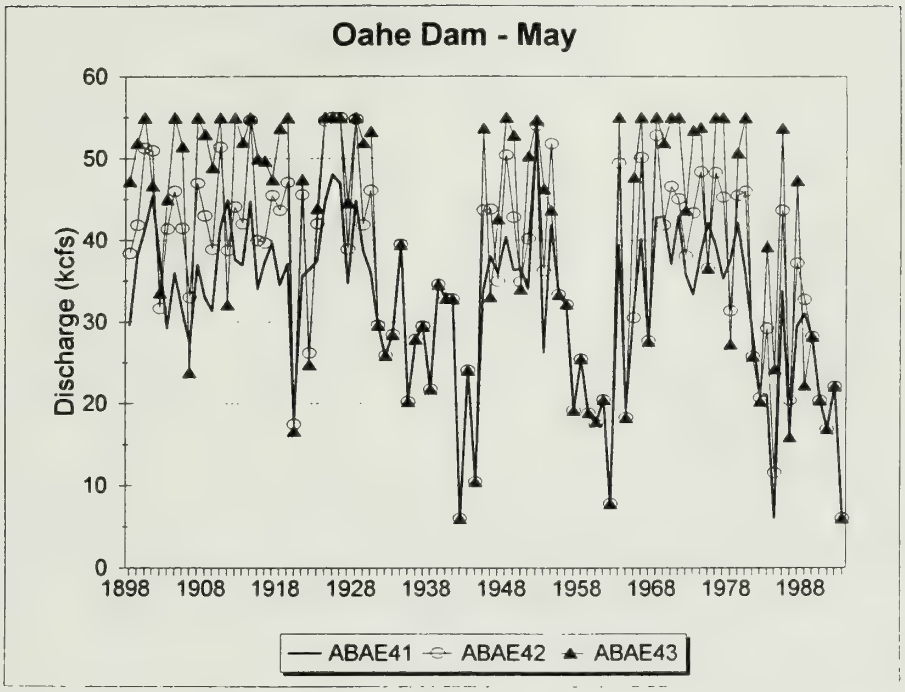

Figure 2-5. Average monthly water releases for month of May from Lake Oahe over the 96-year simulation period for three alternatives with three different spring service levels.

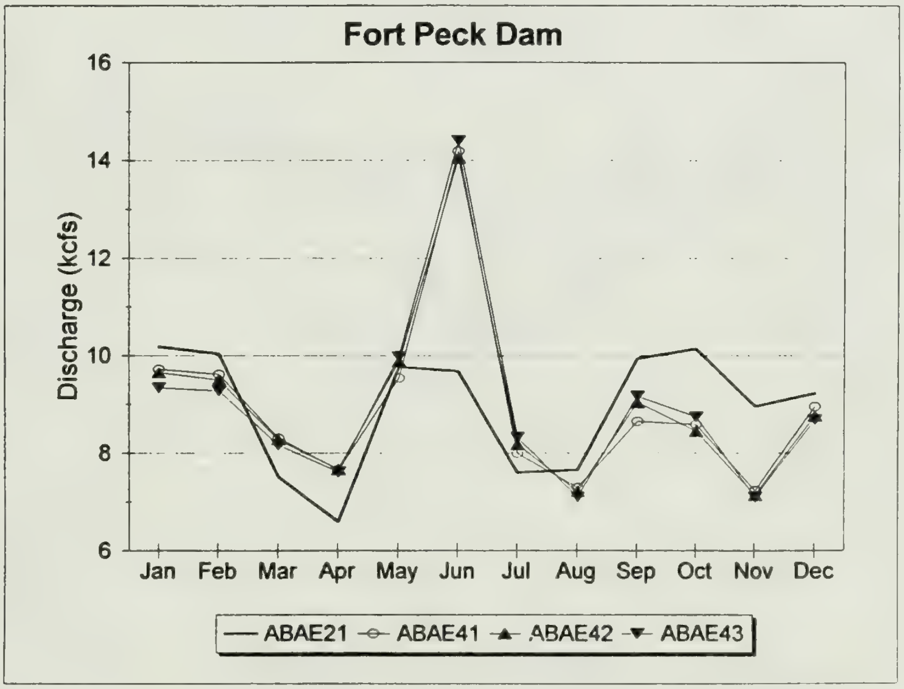

Figure 2-6. Average water releases for each month of the year from Fort Peck Lake over the 96-year simulation period for four alternatives with different spring service levels.

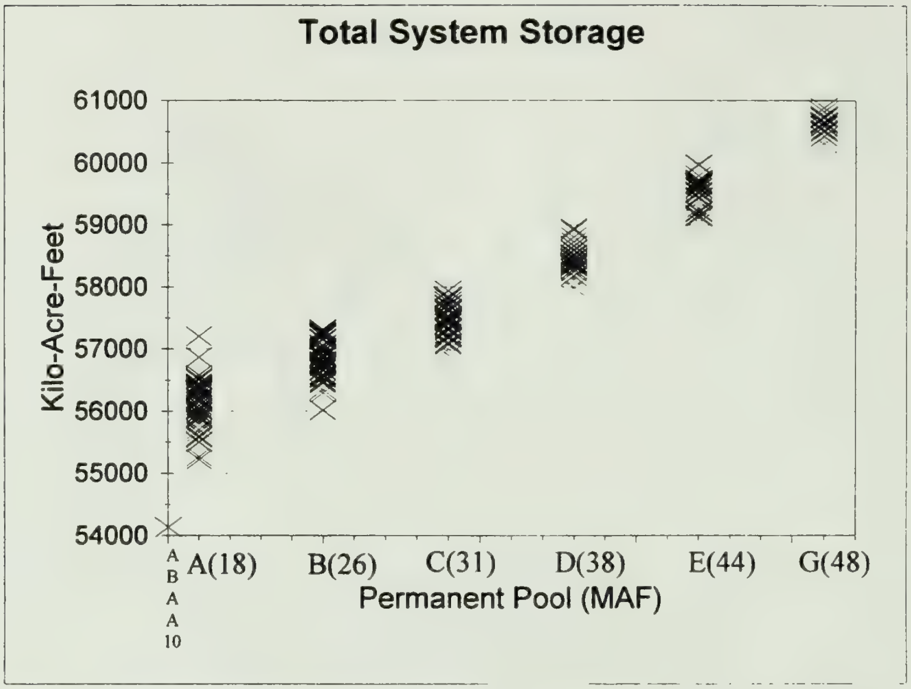

Figure 2-7. Average annual total system storage in the six mainstem lakes for the Basic Set of alternatives for the 96-year simulation period.

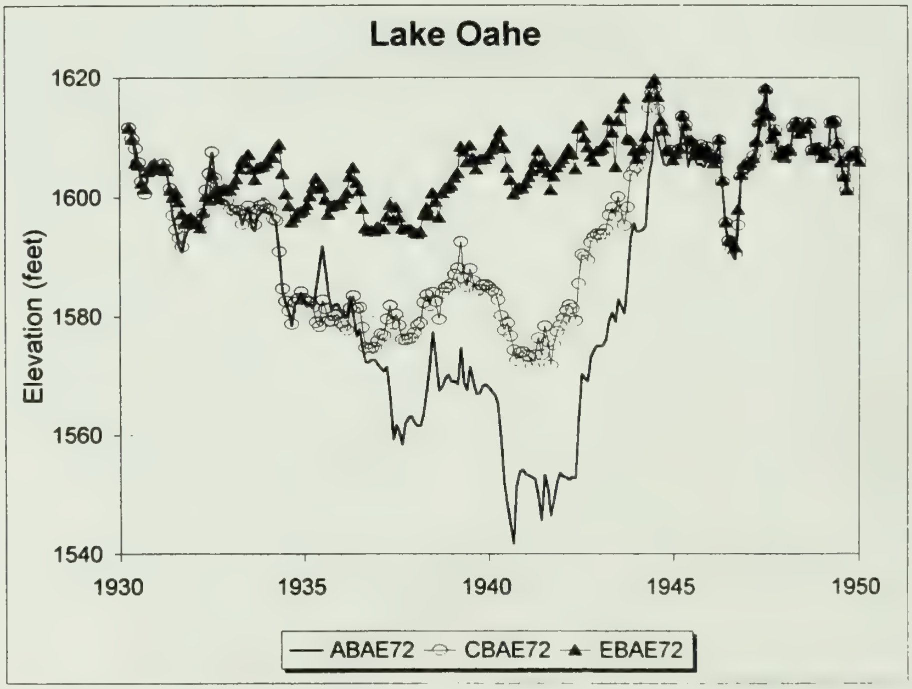

Figure 2-8. Average monthly water surface elevation in Lake Oahe over the simulation period 1930 to 1950 for alternatives ABAE72, CBAE72, and EBAE72.

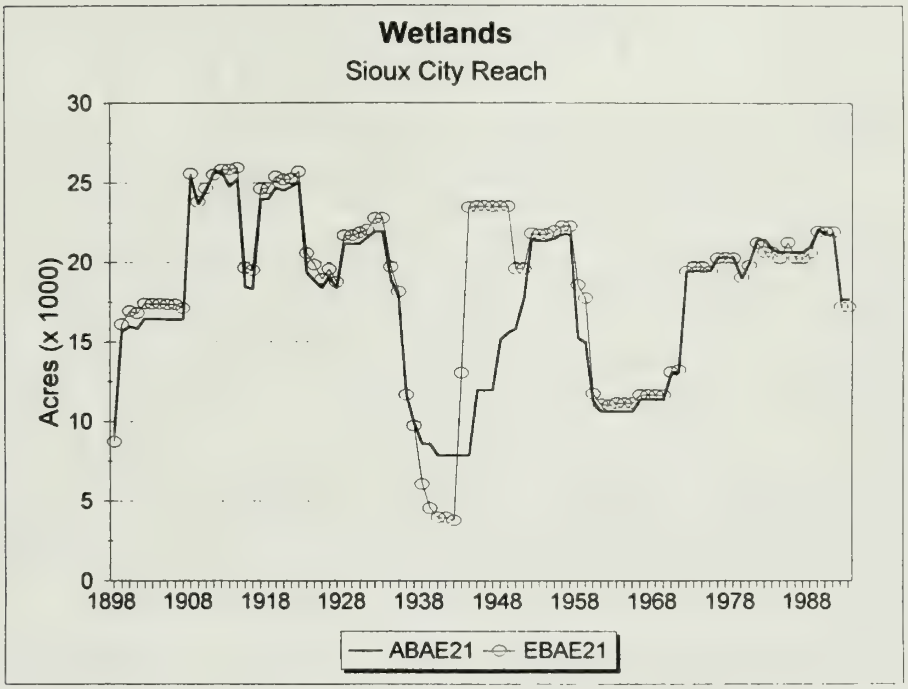

Figure 2-9. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for alternatives ABAE21 and EBAE21.

3.0 SYSTEM HYDROLOGY

Lake levels and river flows below the six mainstem dams vary considerably among the water control plans (system operational alternatives) being considered. Modified navigation criteria, which would result in more months of reduced or no navigation service, decrease the amount of water required to support navigation, and thus reduce storage releases (reservoir discharges) in periods of drought. Modified intrasystem regulation of storage affects seasonal lake-level and water-release patterns in the upper three lakes. Minimum nonnavigation service levels control storage water releases during nonnavigation months and flows below the dams during drought periods. Increases in spring flows to enhance native fish habitat in the Missouri River affect releases from the lakes and therefore lake levels. Permanent pool level criteria determine how low total system water in storage is allowed to fall during droughts. Permanent pool level also affects the extent to which navigation can be supported and the amount of water that can be released from each dam to meet multiple downstream purposes.

Understanding system hydrology, defined in terms of total system storage volume lake levels and water releases, is crucial for evaluating the impacts that the operational alternatives will have on system beneficial uses, such as fish, navigation, and recreation.

This section describes how the operational alternatives affect system hydrology. The alternatives are compared against the current Water Control Plan or Base Case (ABAA10). Potential effects of changes in operations are described in the following order:

- The effects of the modified navigation and intrasystem storage regulation criteria
- The effects of nonnavigation service level
- The effects of increasing spring service level to enhance native river fish
- The effects of increasing the permanent pool level

3.1 EFFECT OF THE MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

3.1.1 Modified Navigation Criteria

The effects of the modified navigation criteria were evaluated by comparing the Base Case (ABAA10) and alternative ABAA11 with alternatives ABAA20 and ABAA21, respectively. The modified criteria reduce demands on storage from navigation during drought periods (1930s, 1950s, and late 1980s). The effects show up as increased lake levels for the three main storage reservoirs (Figures 3-1 to 3-3), an increase in the total system water in storage (Figure 3-4), and lower releases from the dams (Figures 3-5 to

3-8). Lake Francis Case is drawn down more quickly during the onset of a drought under the modified navigation criteria, and recovers storage more slowly (Figure 3-9).

To examine the effects of reduced navigation service in drought periods from the modified navigation criteria, the monthly discharges at Gavins Point Dam were plotted for the 96 years of simulation (Figures 3-10 to 3-21). These figures show two patterns of monthly discharge: navigation (April to November) and nonnavigation (December through March). In addition, close examination of the results for the navigation period reveals that during the major droughts, minimum navigation service (about 29 kcfs at Gavins Point Dam) ceases at the end of September (instead of November) and there is a large decrease in discharge from Gavins Point Dam (and therefore from the three major upstream reservoirs). This reduction in outflow, and a saving of upstream storage, allows minimum navigation service (a 6-month season from April to September) to be maintained during all drought years. Conversely, under the existing navigation criteria, 8 months of service at the beginning of the 1930s drought produce a greater loss of storage and a subsequent elimination in navigation service towards the end of that drought in 1937.

3.1.2 Modified Intrasystem Regulation

Comparing alternatives ABAA10 with ABAA11 and ABAA20 with ABAA21 show the effects of modified intrasystem regulation.

Modified intrasystem regulation has little or no effect on annual average reservoir elevations or annual discharge patterns (Figures 3-1 to 3-9). To examine this effect more closely, the reservoir elevations and discharges were plotted for May of each year (Figures 3-22 to 3-28). The effect on discharges is most pronounced. The effect on Fort Peck Lake is small (Figure 3-22) with only slightly lower elevations evident in 2 out of 3 years and higher elevations in the third year. The effect on Lake Sakakawea and Lake Oahe is greater with 2- to 3-foot fluctuations at Lake Sakakawea (Figure 3-24) and 3- to 5-foot fluctuations at Lake Oahe (Figure 3-26). The effect at Lake Francis Case is small (Figure 3-28).

Although average annual discharges from the three major upstream reservoirs are similar between alternatives ABAA10 and ABAA20 and alternatives ABAA11 and ABAA21, the monthly distribution of storage varies within a year. Spring flows are higher every third year and lower the other 2 years for the alternatives with modified intrasystem regulation (ABAA11 and ABAA21). Late summer and fall flows adjust to balance the annual flow altered by the spring flows. Winter flows (nonnavigation months) are relatively unaffected by modified intrasystem regulation. Using Garrison Dam as an example, modified intrasystem regulation affects discharges in April and May (Figures 3-32 and 3-33), as the reservoir is quickly filled in 1 year out of 3, and used to fill either Fort Peck Lake or Lake Sakakawea in the other 2 years. The reservoir responds to this altered spring discharge in varying degrees for the rest of the year. During the remainder of the navigation season (June to November), the reservoir begins to compensate for the adjustments in spring flow, lowering the reservoir if it was filled in the spring, or reducing discharges in the fall (Figures 3-34 to 3-39). It should be noted, however, that releases in these months represent a complicated mixture of inflows, intrasystem regulation compensation, navigation and nonnavigation flows, and reservoir evacuation for flood control. Finally, in the winter months of December to March, there is little difference in the reservoir releases (Figures 3-29 to 3-31 and Figure 3-40).

Modified intrasystem regulation has little direct effect on releases from Oahe Dam. However, indirect effects occur due to changes in water in storage patterns in Lake Oahe, which translate to small increases in spring flows below Fort Randall Dam and Gavins Point Dam (Figures 3-13 and 3-14).

3.1.3 Combined Effects of Modified Navigation and Intrasystem Regulation Criteria

The modified navigation criteria have the greatest influence on reservoir elevations. During the 1930s drought the modified navigation criteria result in higher reservoir elevations (Figures 3-3 and 3-4). By contrast, modified intrasystem regulation has little effect on reservoir elevations on an average annual basis. Together, the effects of the two factors are sometimes additive or opposing. During drought periods, the influence of the modified navigation criteria dominates the effects (Figure 3-6). By contrast, during non-drought periods when navigation criteria are unchanged, the only effect is that of modified intrasystem regulation (Figure 3-33).

This same pattern occurs in the reservoir discharges. Figure 3-6, for example, shows little effect of modified intrasystem regulation on discharges; whereas, the adjustment of flows from the modified navigation criteria during the drought periods is clearly seen. During the months of intrasystem regulation, such as May (Figure 3-33), the effects on discharges are readily observed. Discharges from the upper three dams tend to fluctuate more widely in spring regulating months than in other months.

Also of note are the higher discharges in May from Fort Peck Dam (Figure 3-23), Garrison Dam (Figure 3-25), and Oahe Dam (Figure 3-27) under alternative ABAA21. Modified intrasystem regulation has a more dramatic effect on water releases from these dams than the modified navigation criteria. The combination of the modified intrasystem regulation and extra storage under the modified navigation criteria results in higher May discharges.

3.2 MINIMUM NONNAVIGATION SERVICE LEVELS

The effects of minimum nonnavigation service levels on system hydrology are examined in this section. Minimum nonnavigation service levels generally apply only during drought periods, thereby only affecting demands on storage during and immediately following drought periods when storage levels are below normal. During the winter, minimum nonnavigation service levels apply throughout drought periods when flood evacuation and tributary inflow are insufficient to protect beneficial uses, such as water supply intakes on the river. In contrast, spring through fall minimum nonnavigation service levels only apply when navigation service is not supported by system releases. Season-long flow reductions are frequent during droughts and lead to initiation of minimum nonnavigation service levels in the fall. Spring and summer minimum nonnavigation service levels are invoked only in months when navigation is not supported. At the lowest permanent pool level (18 MAF), navigation is supported in nearly all years of the simulation, whereas at the highest permanent pool level (48 MAF) navigation is supported in fewer years of a multiyear drought. Navigation season length is also shorter more often with higher permanent pools.

3.2.1 Effect of Winter Minimum Service Level

Higher winter minimum service levels would reduce the total average annual system water in storage as well as water-surface lake elevations for alternatives at lower permanent pool levels. However, higher winter service levels would have little effect on average annual storage for alternatives at higher permanent pool levels (Figures 3-41 to 3-44). At the lowest permanent pool level (18 MAF), higher winter minimum service levels draw down the lakes progressively more during and following droughts, such as the 1930s drought (Figure 3-45). This drawdown results from higher storage releases meeting the higher winter service level (Figure 3-46). Figures 3-45 and 3-46 illustrate that during the peak of the drought, 1938 and 1939, water levels increased while spring-summer flows decreased for the higher service level because total annual storage dropped enough in 1938 to trigger consecutive nonnavigation seasons. For the two lower winter service level alternatives, minimum service was maintained for 5 to 6 months in 1938 and 1939.

At the highest permanent pool level (G level; 48 MAF), there is little or no average effect of winter minimum service level over the 96-year simulation period (Figure 3-44) because higher winter service levels reduce storage sufficiently to reduce navigation service earlier in a drought period (as seen for the B and D service levels in Figures 3-47 and 3-48). Higher winter minimum service levels and the corresponding reduction in navigation service balance out the demands on storage. (Note that the B and D service levels did not reduce navigation service early in drought at the lower permanent pool level [Figure 3-45]. Both these winter service levels drafted the system's storage enough in early 1932 to preclude navigation releases in the spring and summer [Figure 3-48]; whereas, at the A service level, enough storage was retained to provide navigation releases for part of the spring and summer.)

3.2.2 Effect of Summer Minimum Nonnavigation Service Level

Raising the summer minimum nonnavigation service level would have a slightly different effect on storage-and-release patterns compared to raising the winter service level (Figures 3-41 to 3-44). At lower permanent pools, there is little or no effect (Figures 3-49 and 3-50) because navigation is nearly always supported in summer for the A-pool alternatives even through the drought periods. (Note that the decrease in elevation for the A-pool with higher summer minimum nonnavigation service levels in Figures 3-41 to 3-44 is because of the differing sets of alternatives that were included in the means. For example, there is an AABE21 but not an AABA21 [see Chapter 1 description]. Also, navigation support is less consistent for alternatives with A-pools and higher winter and spring-fall minimum nonnavigation service levels.)

For the higher permanent pool levels, the 96-year average system storage and lake levels with higher summer minimum nonnavigation service levels drop slightly (Figures 3-41 to 3-44). The difference is due to the higher summer storage releases during drought years when navigation is not supported (Figures 3-51 and 3-52).

As the permanent pool levels increase (C pool and higher), the relationship between average reservoir elevation and summer service release becomes flatter, or shows some fluctuations. This result is due to a combination of effects including forced and planned reduction in navigation service, and the number of simulations that failed (because they could not support even minimum service for some resources).

3.2.3 Effect of Spring/Fall Minimum Nonnavigation Service Level

The effect of increasing the spring/fall minimum nonnavigation service level is similar to that described above for the summer level (Figures 3-41 to 3-45). Higher fall minimum nonnavigation service levels come into play in the shortened navigation seasons of drought years, when the higher storage releases (Figure 3-53) result in lower water surface elevations in the upper three lakes that carry over through the rest of the year (Figure 3-54).

3.3 NATIVE FISH SERIES

This section discusses the effects of the Native Fish Series alternatives on system hydrology. Native Fish Series alternatives increase spring storage releases (+10, +20, and +30 kcfs over the existing service levels [35 kcfs at full service] in April, May, and the first half of June) to enhance native fish habitat below Fort Randall Dam and Gavins Point Dam. Flood control constraints on the higher spring flows also vary in these alternatives. Reducing the navigation season by 2 months, either August to September or October to November, to compensate for the spring releases further affects storage and releases.

3.3.1 Effect of Higher Spring Service Levels

Higher spring navigation service levels would reduce average annual system storage levels (Figures 3-55 through 3-59). The effect would be less at higher permanent pool levels because these service levels would apply in fewer drought years. (Minimum nonnavigation service levels would apply in nonnavigation months.) The same pattern occurs for water surface elevations for each of the upper three main storage reservoirs (Figures 3-60 through 3-74).

Average annual spring discharges from the upper three lakes increase with the higher spring service levels (Figures 3-75 through 3-77). The higher spring service levels cause higher spring releases in all but drought years (Figure 3-78). In drought years, flows are reduced to normal full service (35 kcfs), minimum service (29 kcfs), or nonnavigation service levels for months with no navigation service.

Higher spring service levels also cause subsequent lower summer and fall storage releases from the upper three lakes (Figures 3-79 through 3-81). Summer and fall flows are less than the current Water Control Plan and for the lower spring service levels, because less water is required from the annual and exclusive flood control zones of the lakes over the summer and fall of all but the drier years (Figure 3-82).

3.3.2 Effect of Changes in Flood Control Constraints for Navigation

Reducing flood control constraints on the spring releases increases spring storage releases (Figures 3-75 through 3-77) and reduces system water in storage levels (Figures 3-55 through 3-59) and lake water levels (Figures 3-60 through 3-74). Reduced flood control constraints only slightly increase monthly average discharges from the three upper reservoirs in the spring (Figures 3-83 through 3-85). These increases occur in nondrought years (Figure 3-86). There is also a corresponding reduction in releases in the fall (Figure 3-87), because the need to evacuate waters for flood control in wetter years is reduced.

3.3.3 Effect of Shortened Navigation Season

Shortening the navigation season is another component of the Native Fish Series designed to improve native fish habitat. By shortening the navigation season, unnaturally high summer or fall flows for navigation are reduced to natural lower levels.

Shortening the navigation season slightly increases the average annual system storage (Figures 3-55 through 3-59) and lake water surface elevations (Figures 3-60 through 3-74). A shortened navigation season also reduces summer or fall storage releases depending on the months navigation is not supported (Figures 3-88 through 3-96). Summer storage releases are lower in most drought and nondrought years for alternatives that do not support August and September navigation (for example, alternative ABAE62; Figure 3-97). Likewise, fall storage releases are lower for alternatives that do not support October and November navigation (for example, alternative ABAE72; Figure 3-98). Alternatives that do not support August and September navigation are able to support fall navigation more often in drought years (for example, alternative ABAE62; Figure 3-98) because of storage savings in the summer.

3.4 EFFECT OF PERMANENT POOL LEVEL

An increase in the permanent pool level above the existing 18-MAF level would result in an increase in average annual total system storage (Figure 3-99). There would be a corresponding increase in average annual water surface elevation of the upper three mainstem lakes (Figures 3-100 through 3-102). The increase in water surface elevation occurs primarily in drought periods, when water levels are maintained at a higher elevation with higher permanent pools (for example, Figure 3-103). This increase is due to lower storage releases during the drought under higher permanent pools (Figure 3-104), because fewer months of navigation support are allowed the higher the permanent pool level rises.

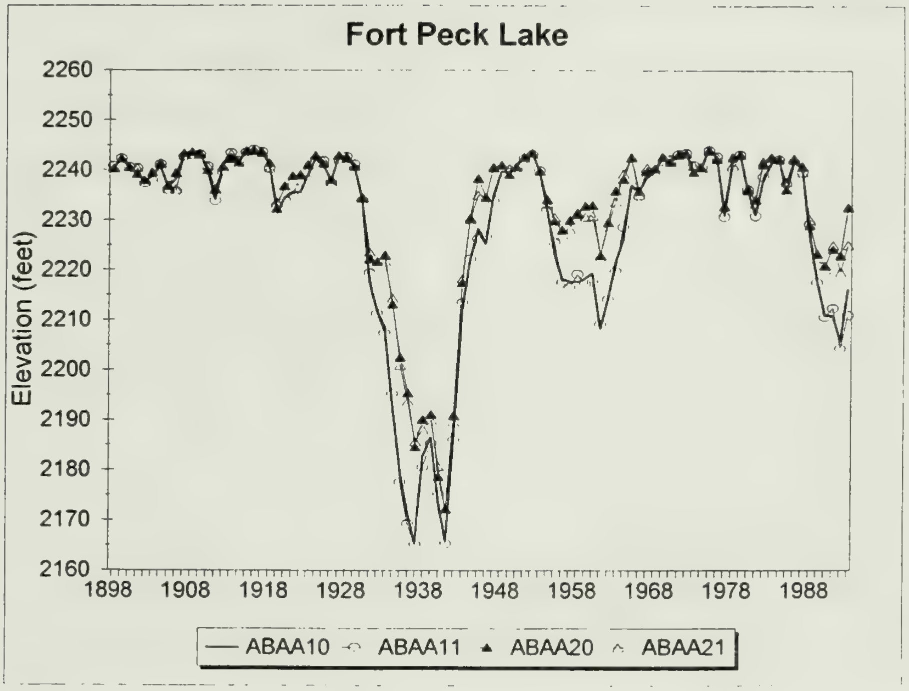

Figure 3-1. Average annual water levels in Fort Peck Lake simulated for four alternatives (1898 to 1993).

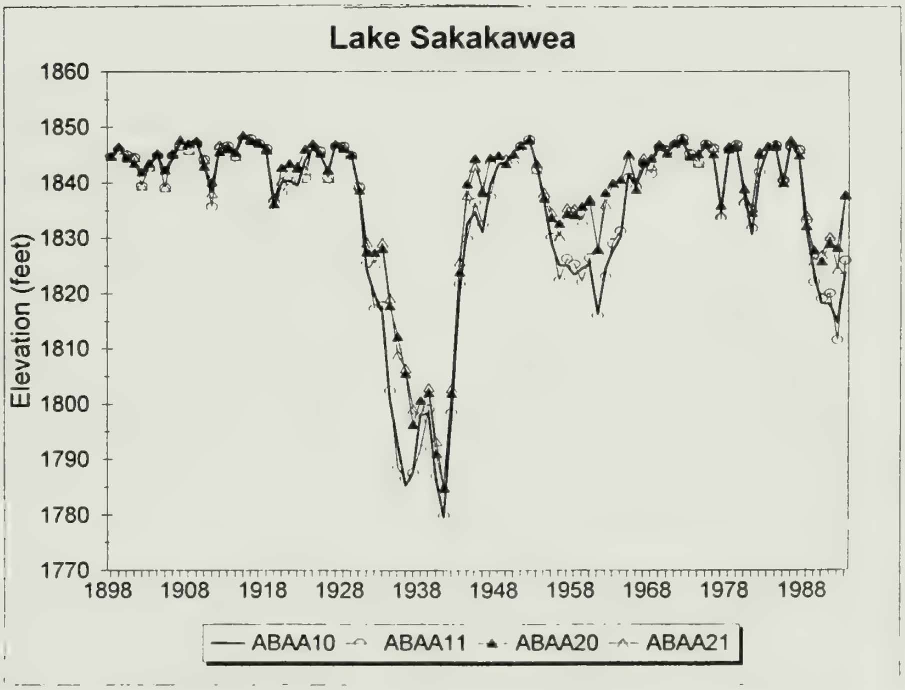

Figure 3-2. Average annual water levels in Lake Sakakawea simulated for four alternatives (1898 to 1993).

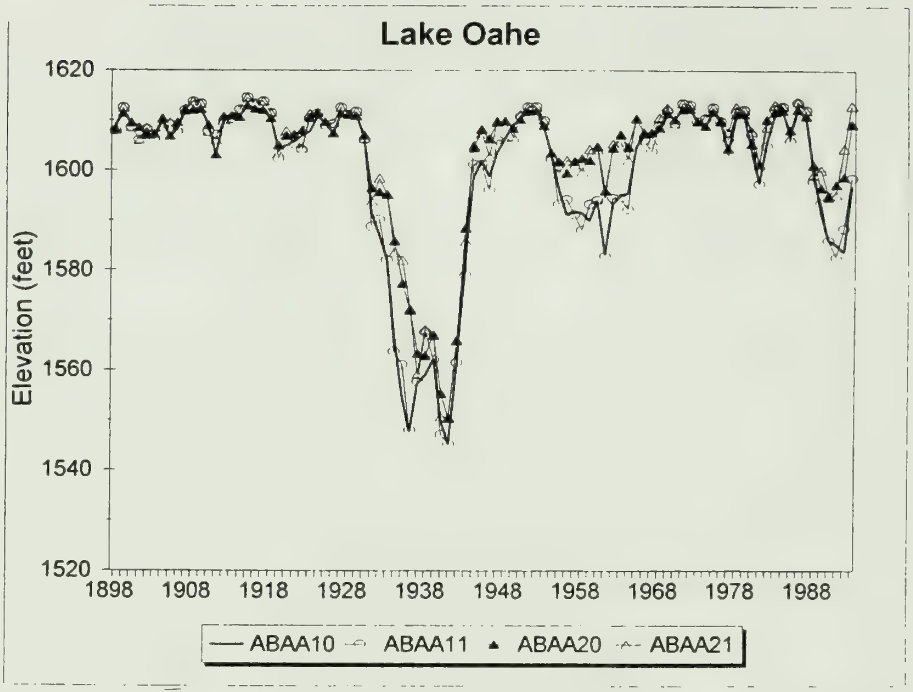

Figure 3-3. Average annual water levels in Lake Oahe simulated for four alternatives (1898 to 1993).

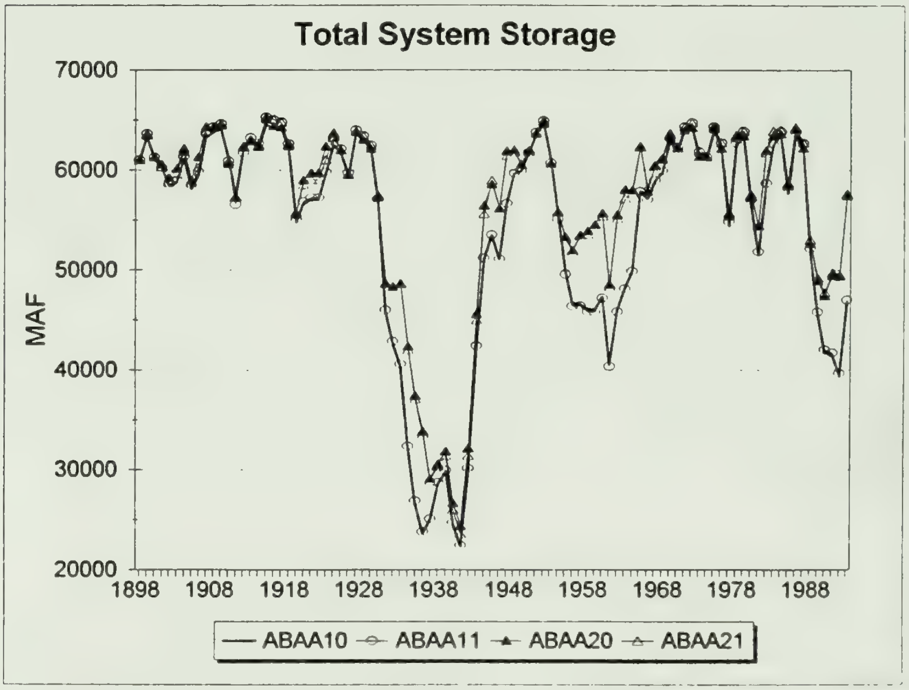

Figure 3-4. Average annual total system storage for four alternatives (1898 to 1993).

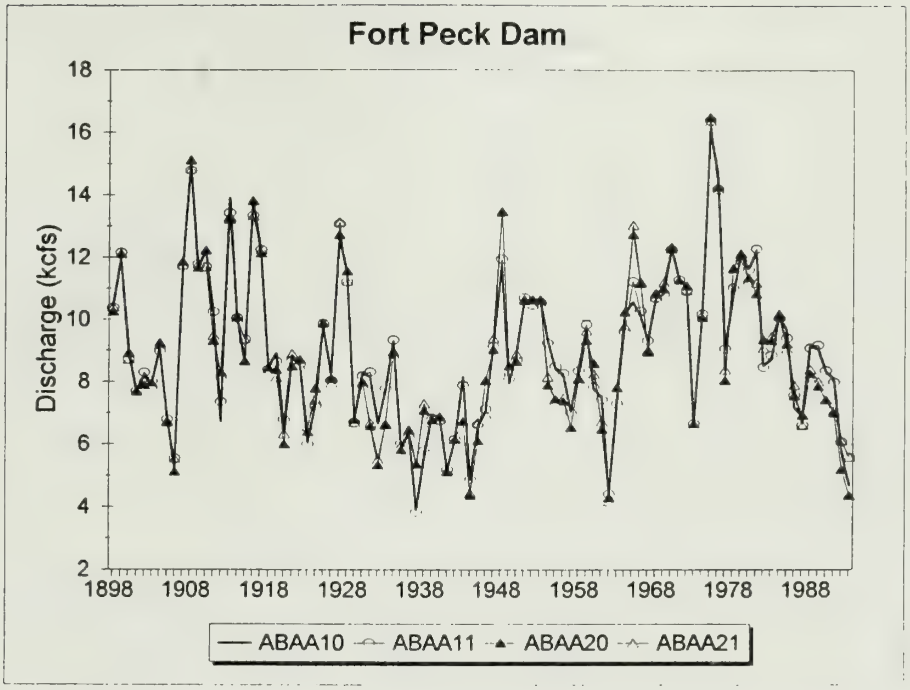

Figure 3-5. Average annual water releases from Fort Peck Dam simulated for four alternatives (1898 to 1993).

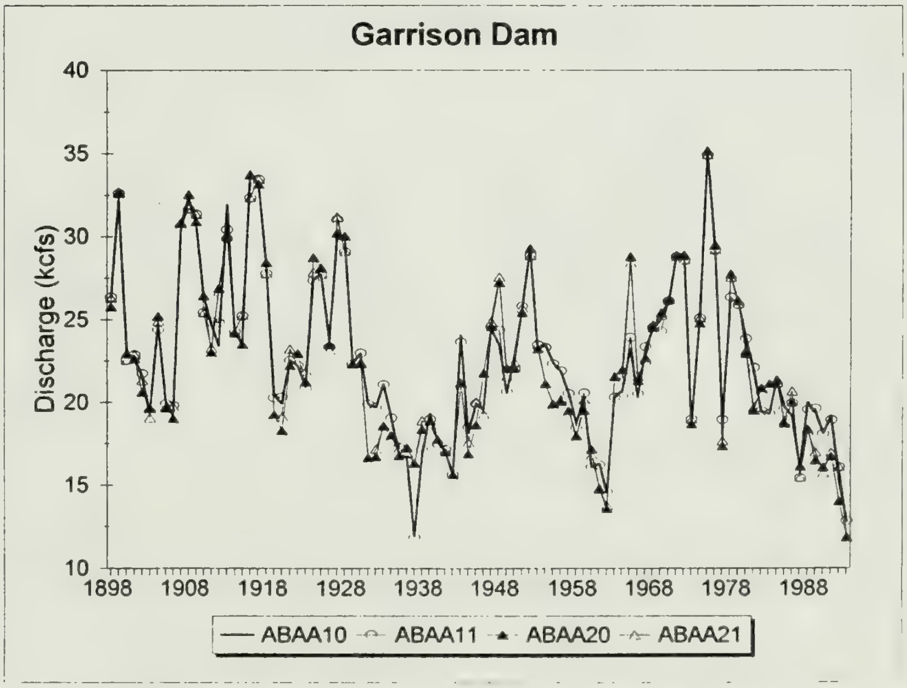

Figure 3-6. Average annual water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

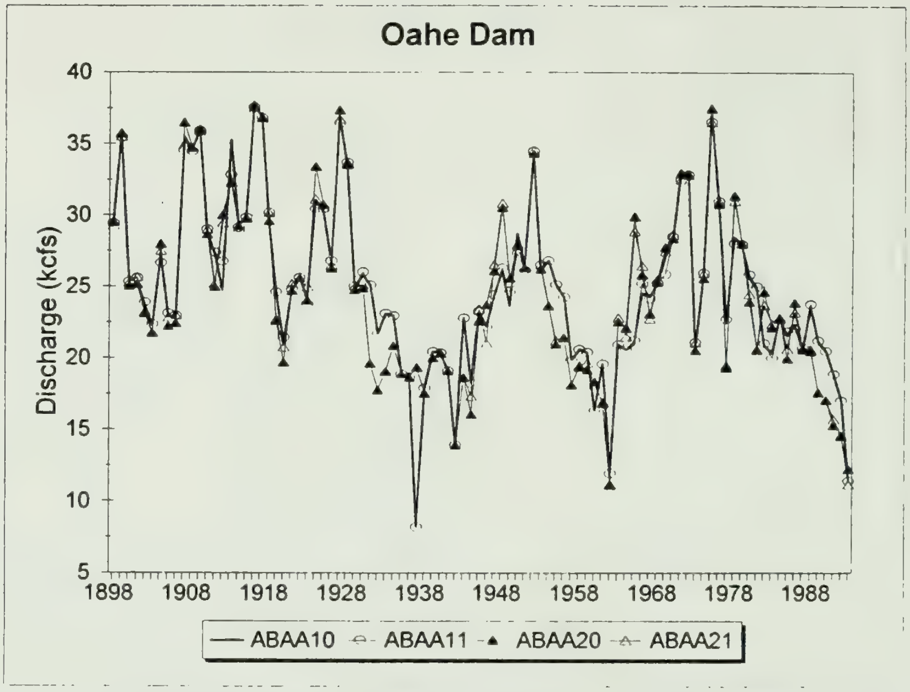

Figure 3-7. Average annual water releases from Oahe Dam simulated for four alternatives (1898 to 1993).

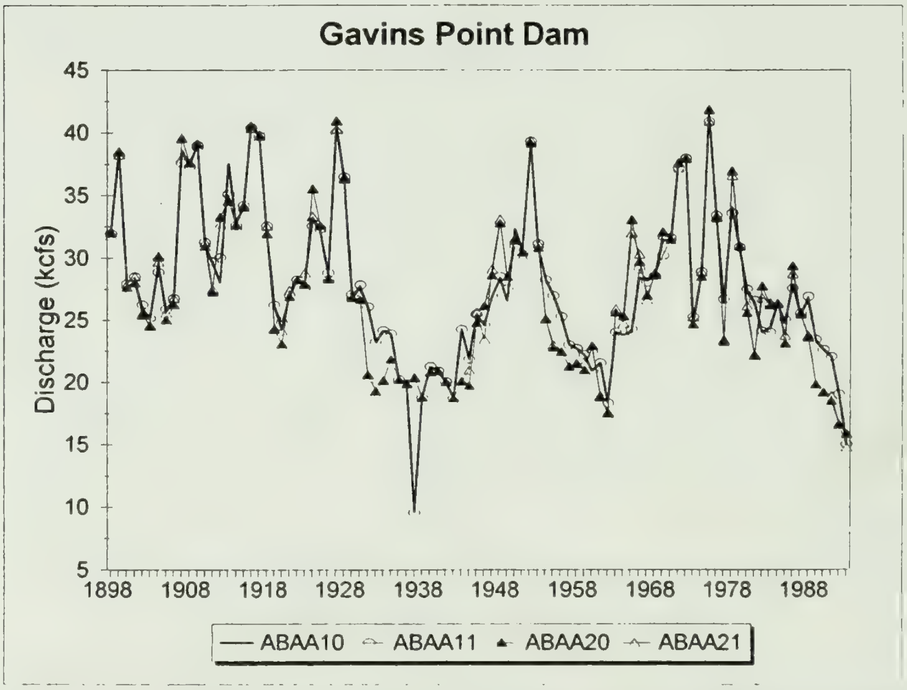

Figure 3-8. Average annual water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

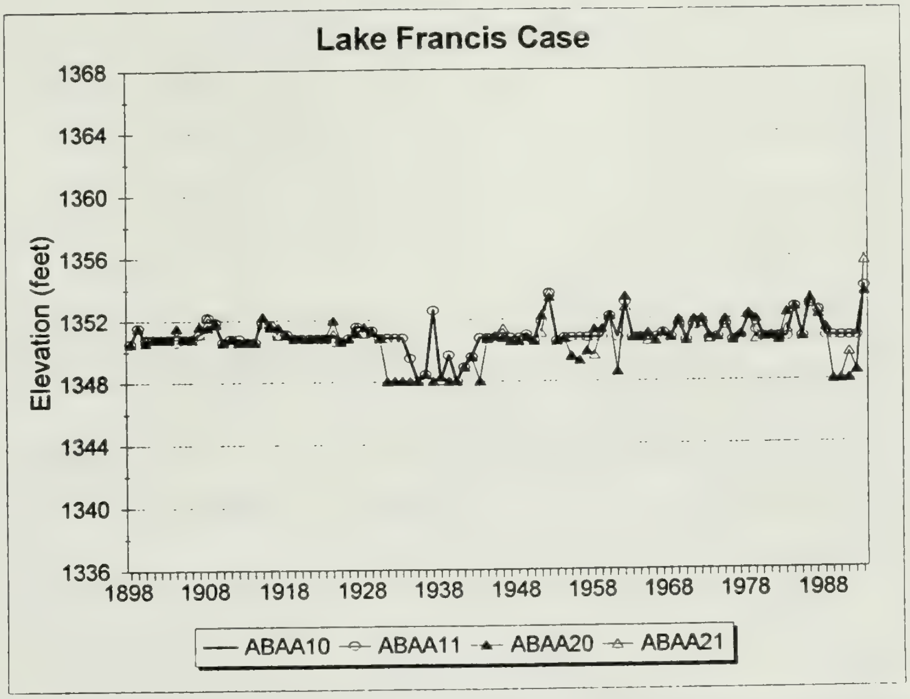

Figure 3-9. Average annual water levels in Lake Francis Case simulated for four alternatives (1898 to 1993).

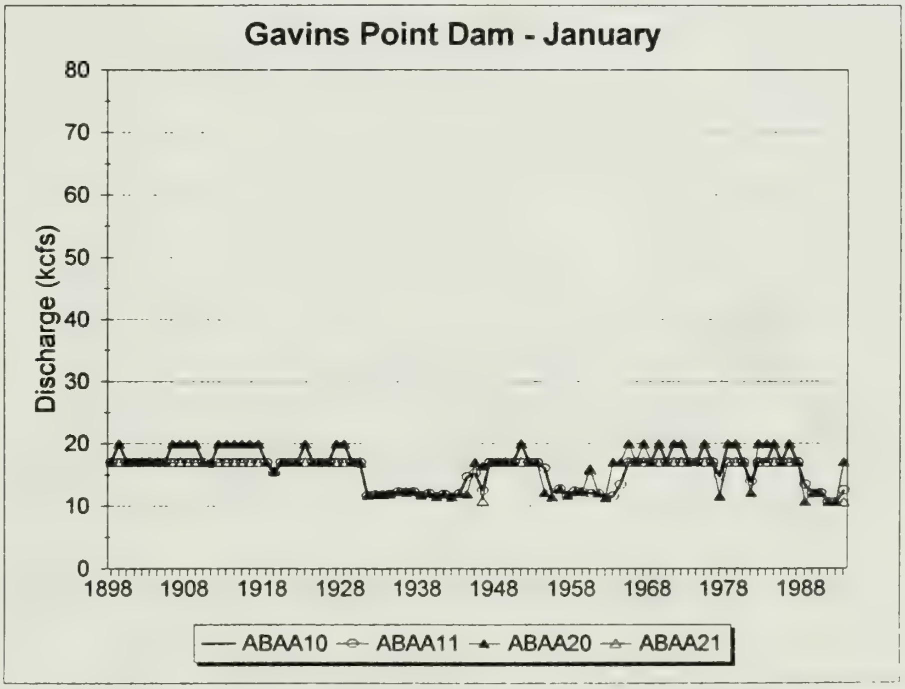

Figure 3-10. Average January water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

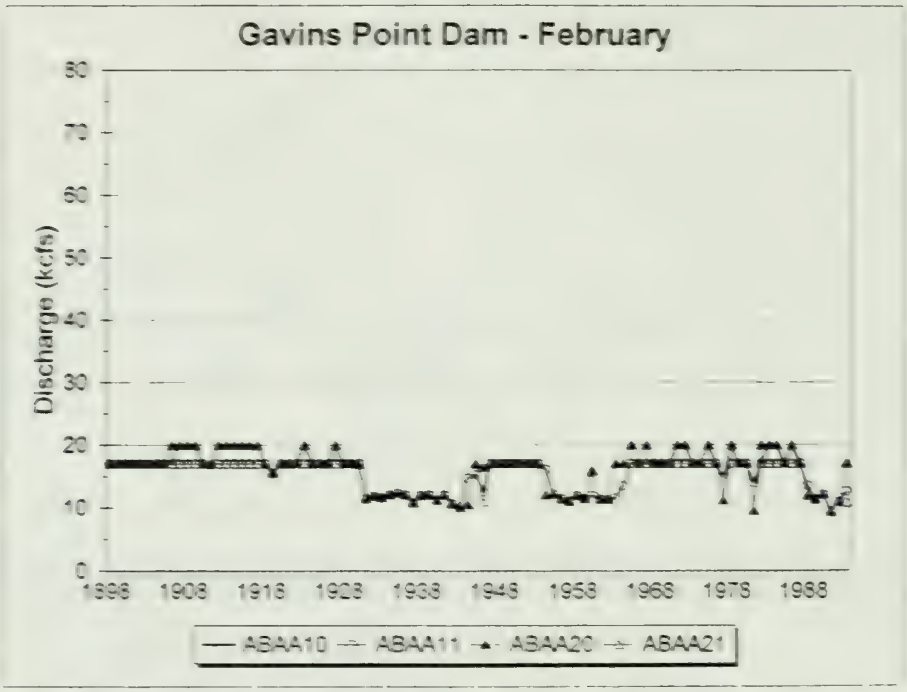

Figure 3-11. Average February water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

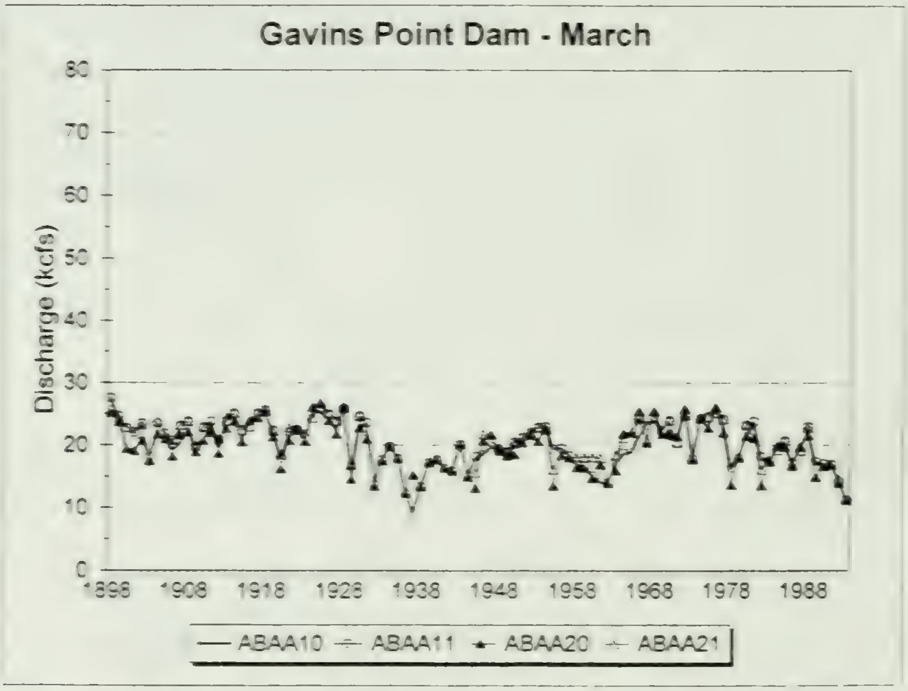

Figure 3-12. Average March water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

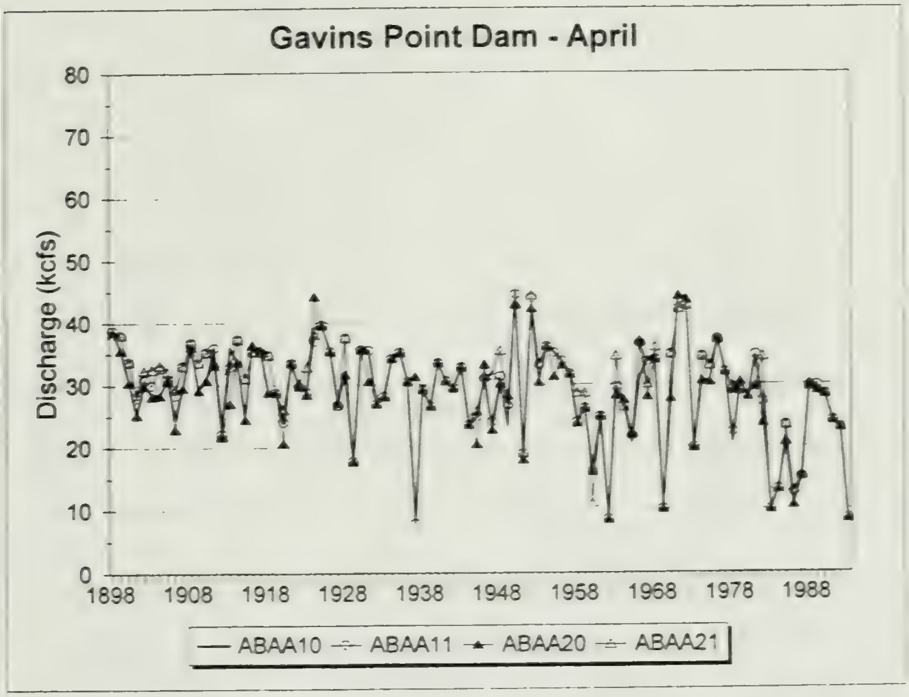

Figure 3-13. Average April water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

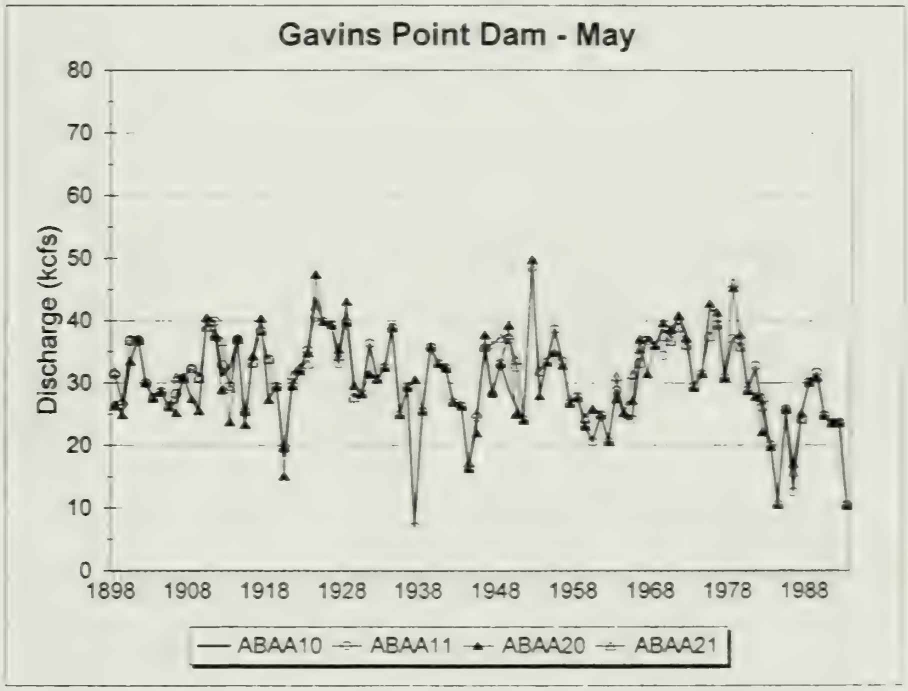

Figure 3-14. Average May water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

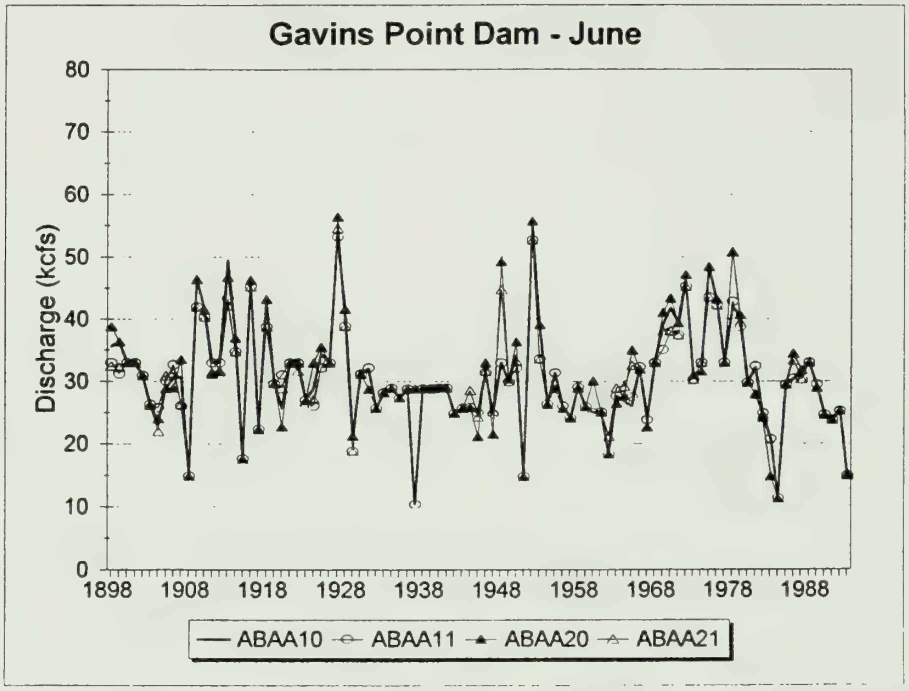

Figure 3-15. Average June water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

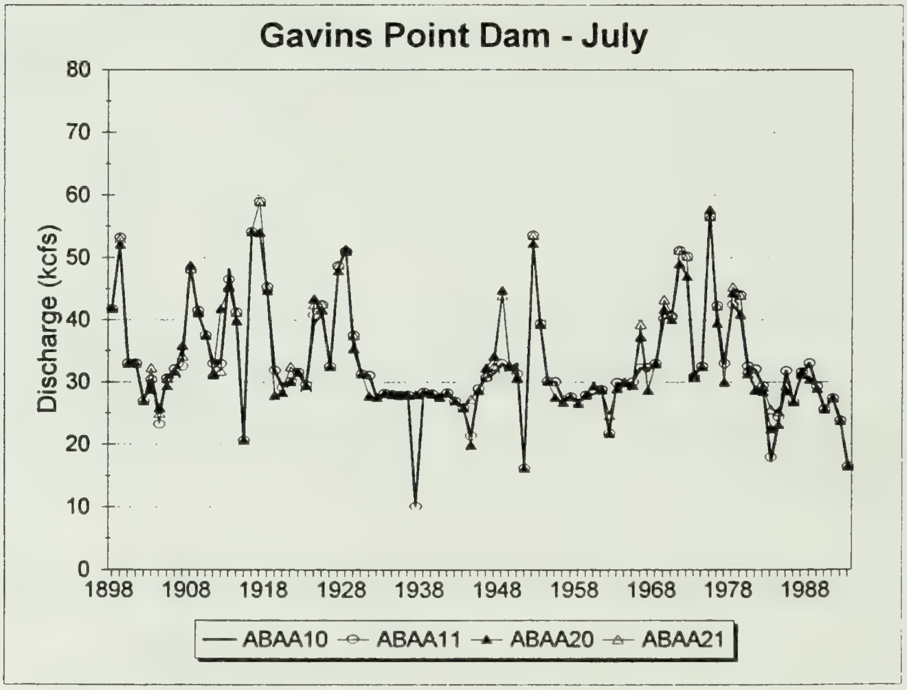

Figure 3-16. Average July water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

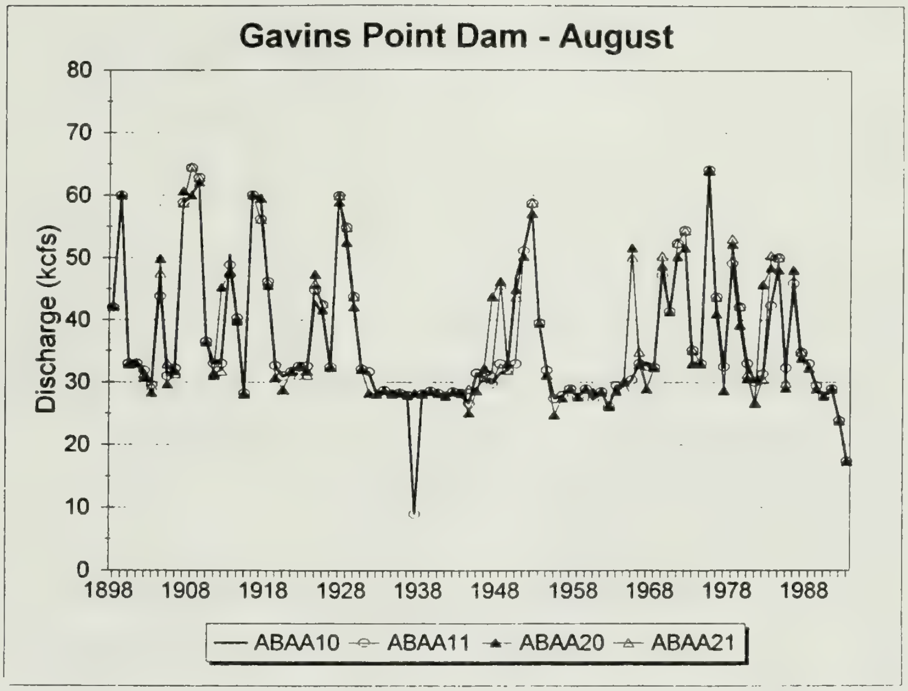

Figure 3-17. Average August water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

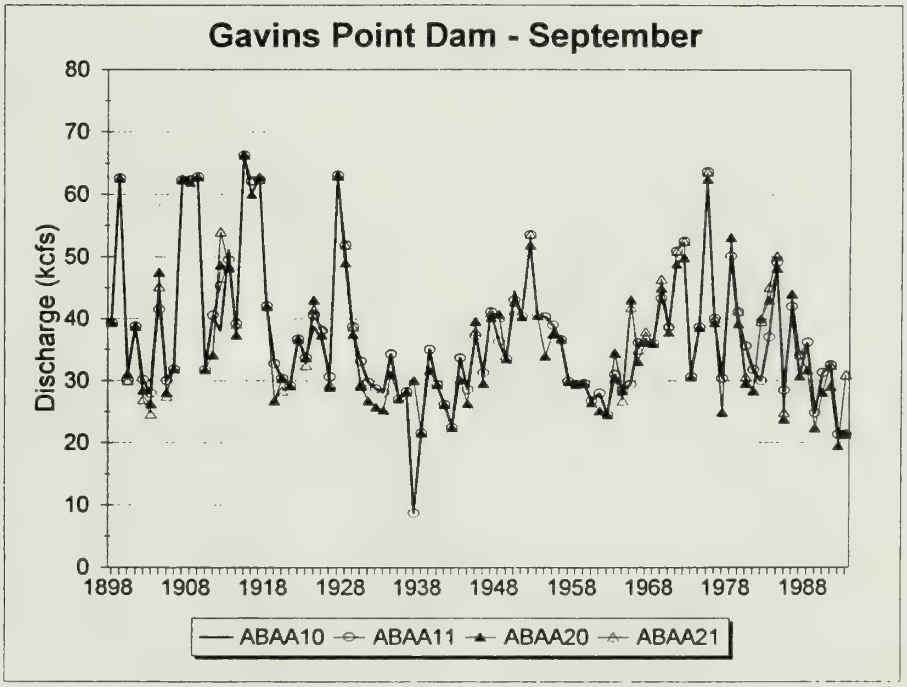

Figure 3-18. Average September water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

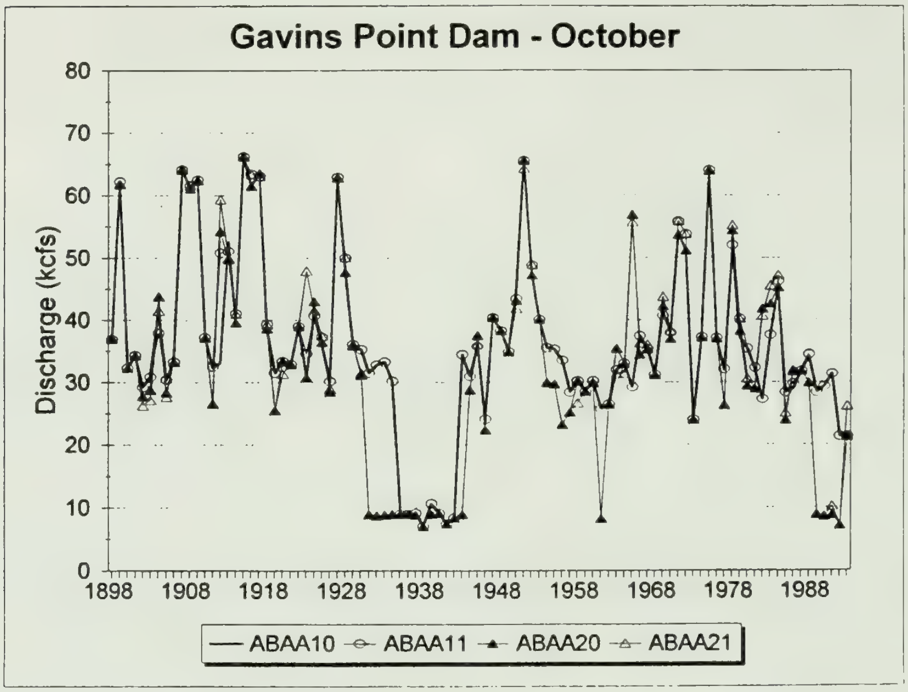

Figure 3-19. Average October water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

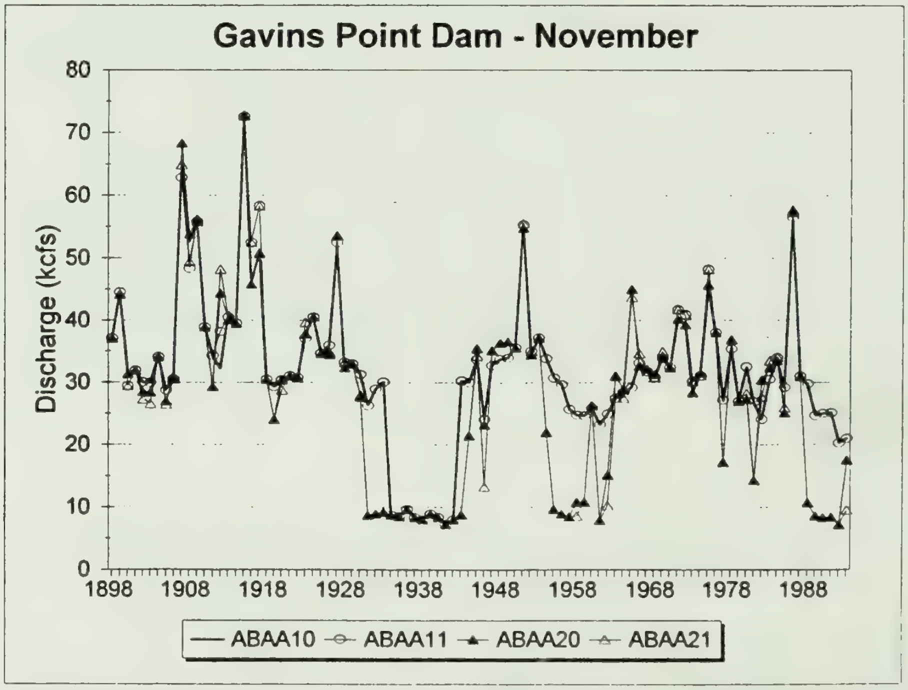

Figure 3-20. Average November water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

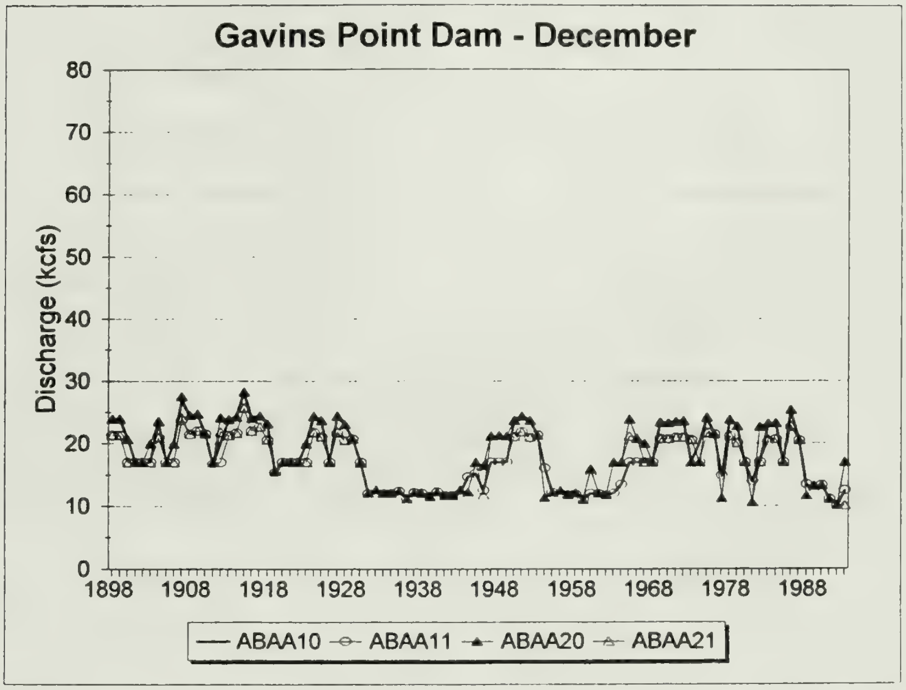

Figure 3-21. Average December water releases from Gavins Point Dam simulated for four alternatives (1898 to 1993).

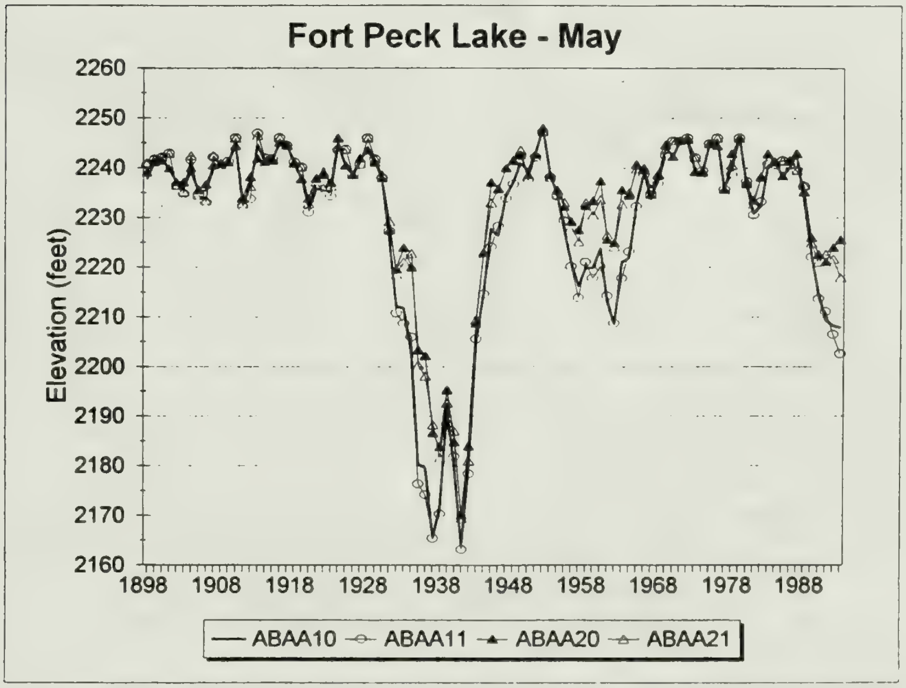

Figure 3-22. Average May water levels in Fort Peck Lake simulated for four alternatives (1898 to 1993).

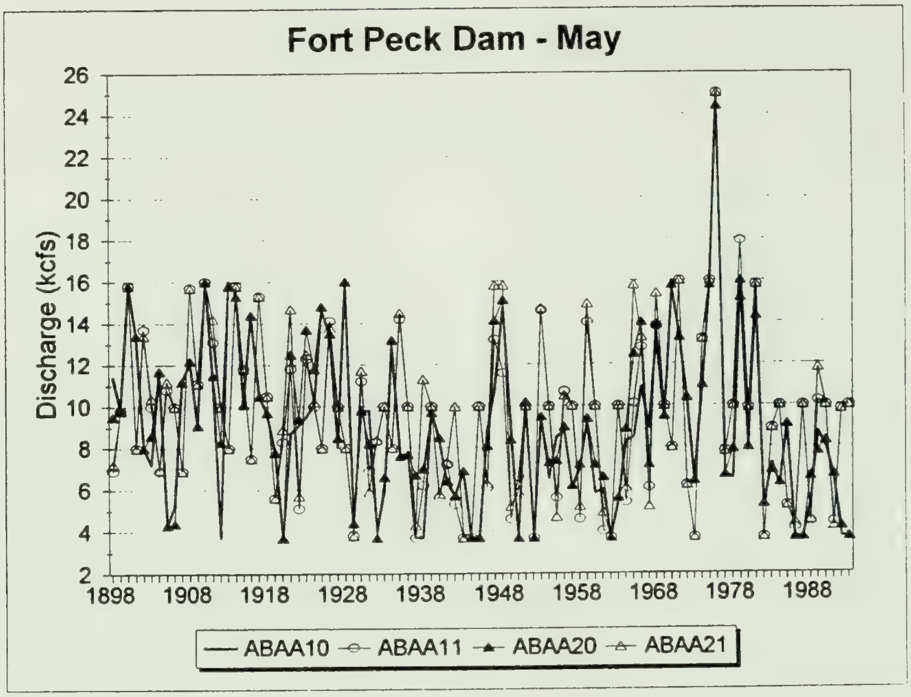

Figure 3-23. Average May water releases from Fort Peck Dam simulated for four alternatives (1898 to 1993).

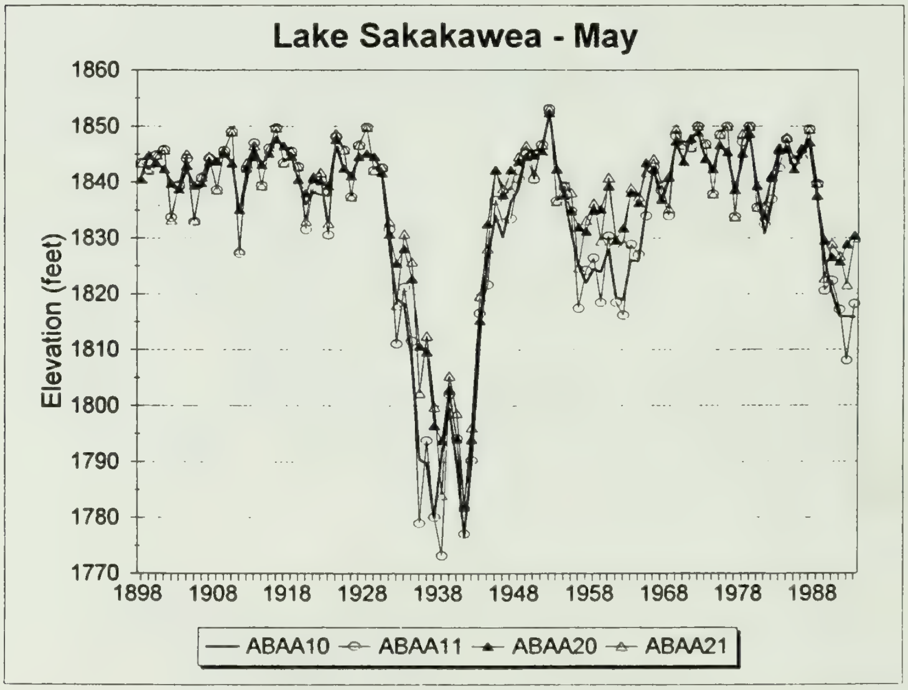

Figure 3-24. Average May water levels in Lake Sakakawea simulated for four alternatives (1898 to 1993).

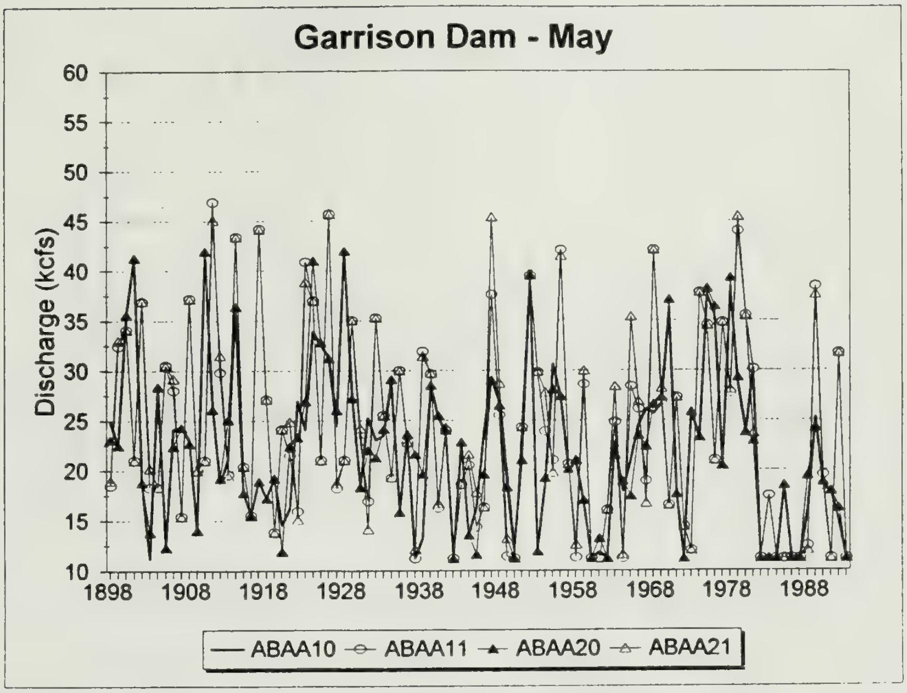

Figure 3-25. Average May water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

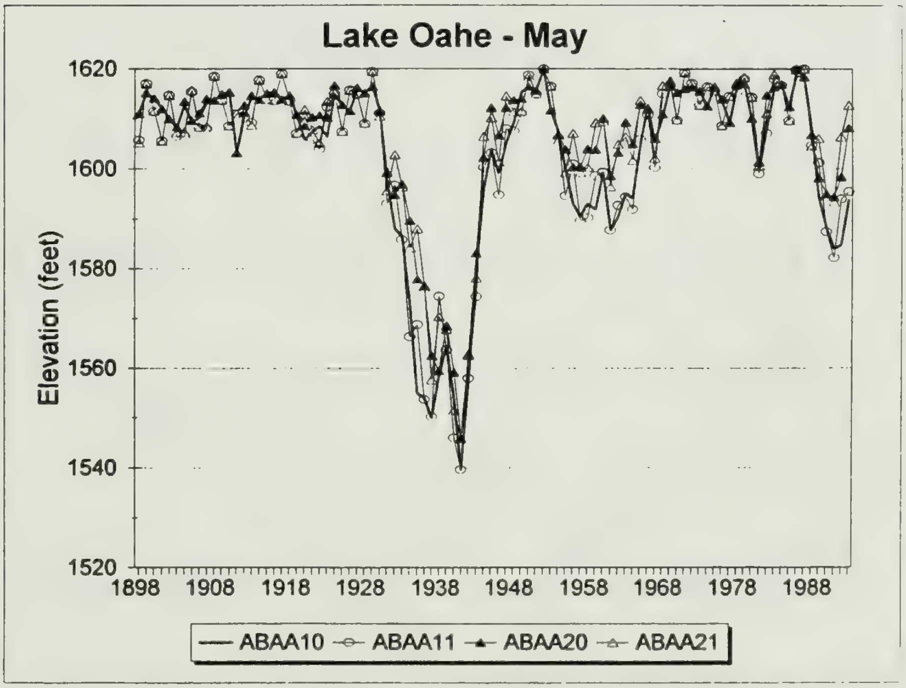

Figure 3-26. Average annual water levels in Lake Oahe simulated for four alternatives (1898 to 1993).

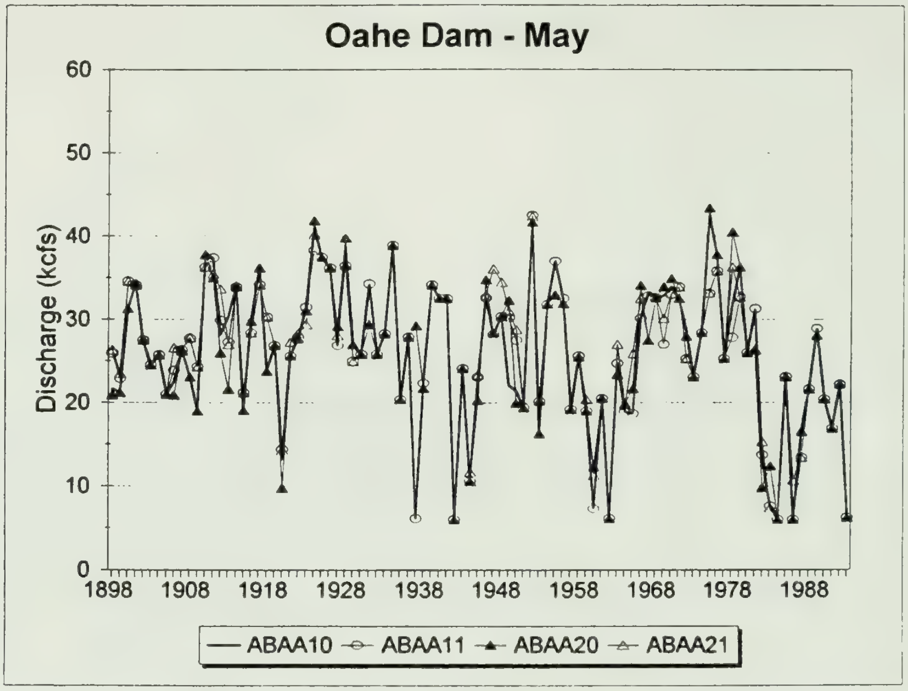

Figure 3-27. Average May water releases from Oahe Dam simulated for four alternatives (1898 to 1993).

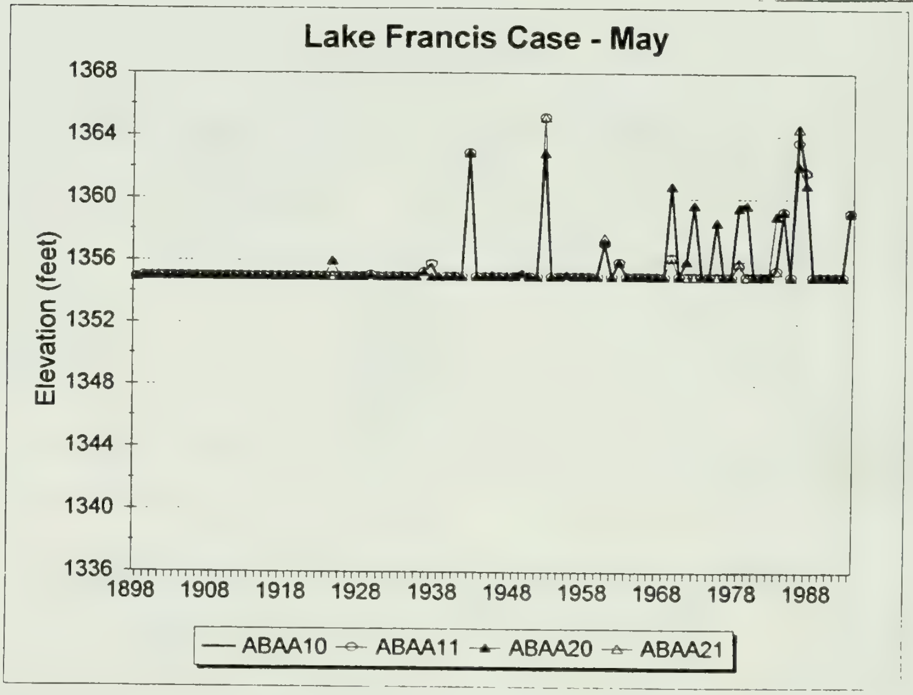

Figure 3-28. Average annual water levels in Lake Francis Case simulated for four alternatives (1898 to 1993).

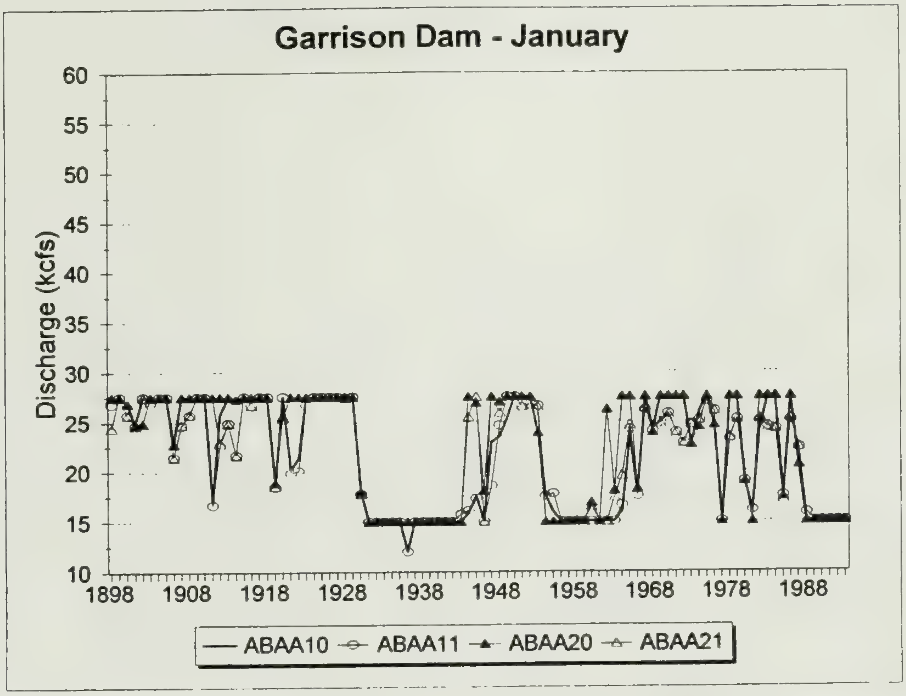

Figure 3-29. Average January water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

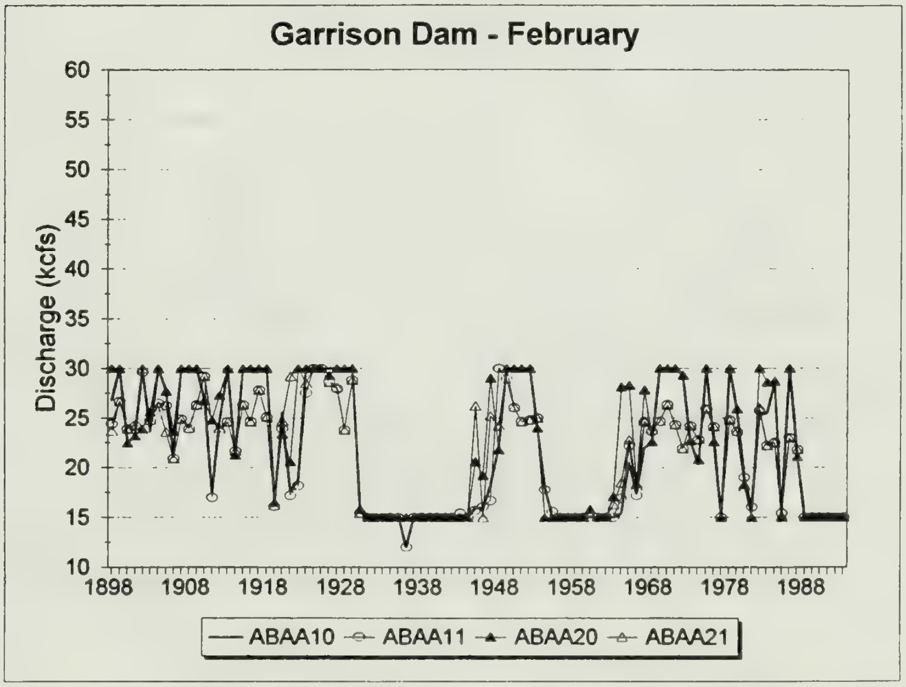

Figure 3-30. Average February water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

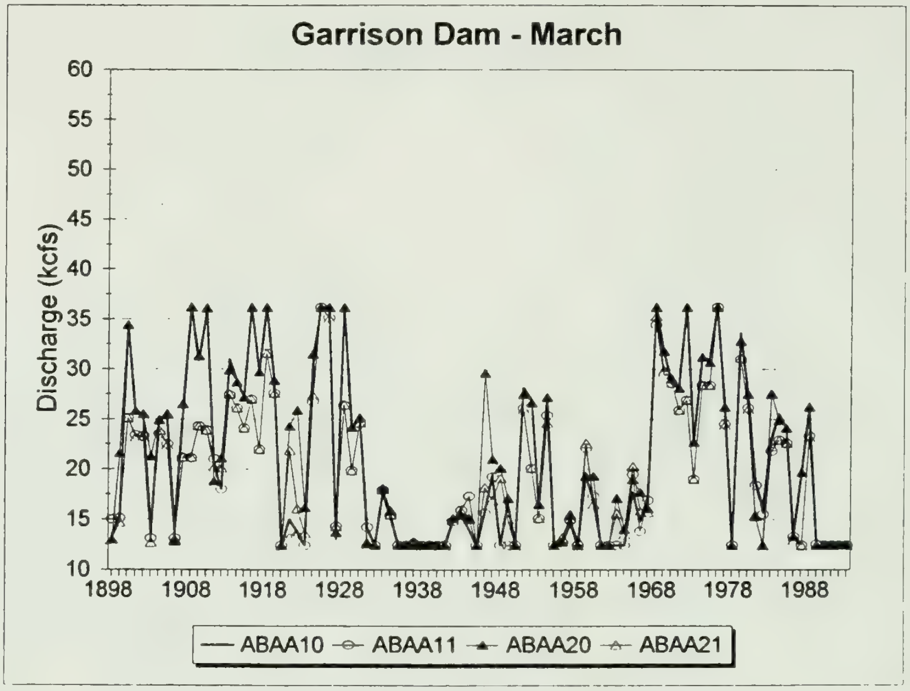

Figure 3-31. Average March water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

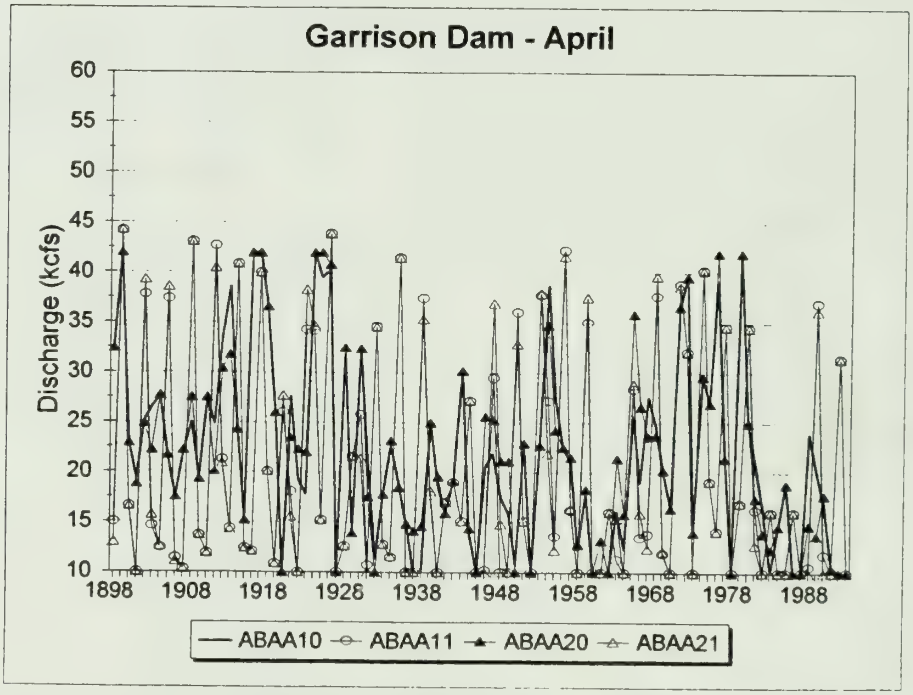

Figure 3-32. Average April water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

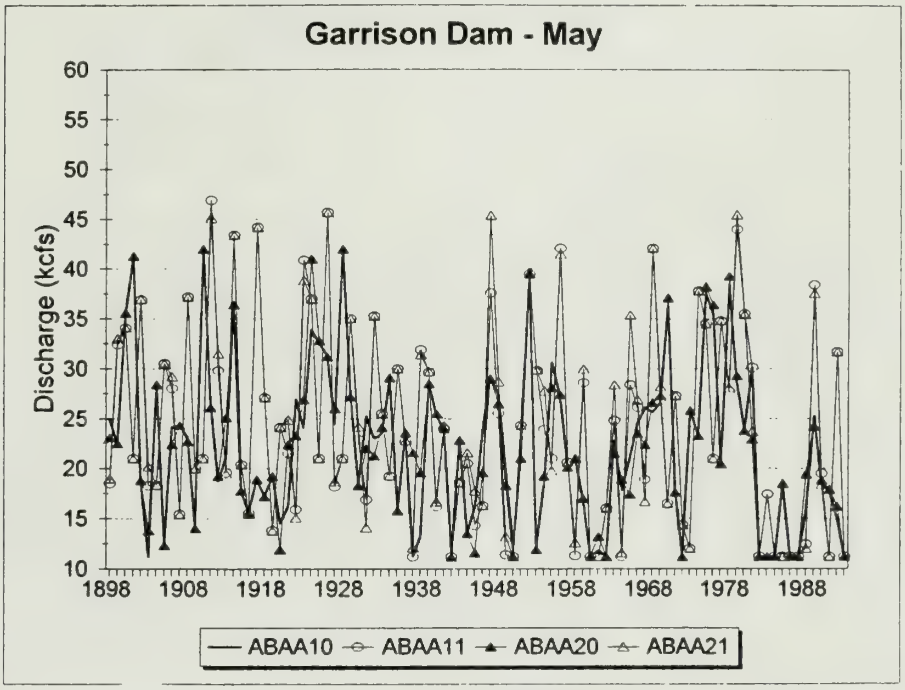

Figure 3-33. Average May water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

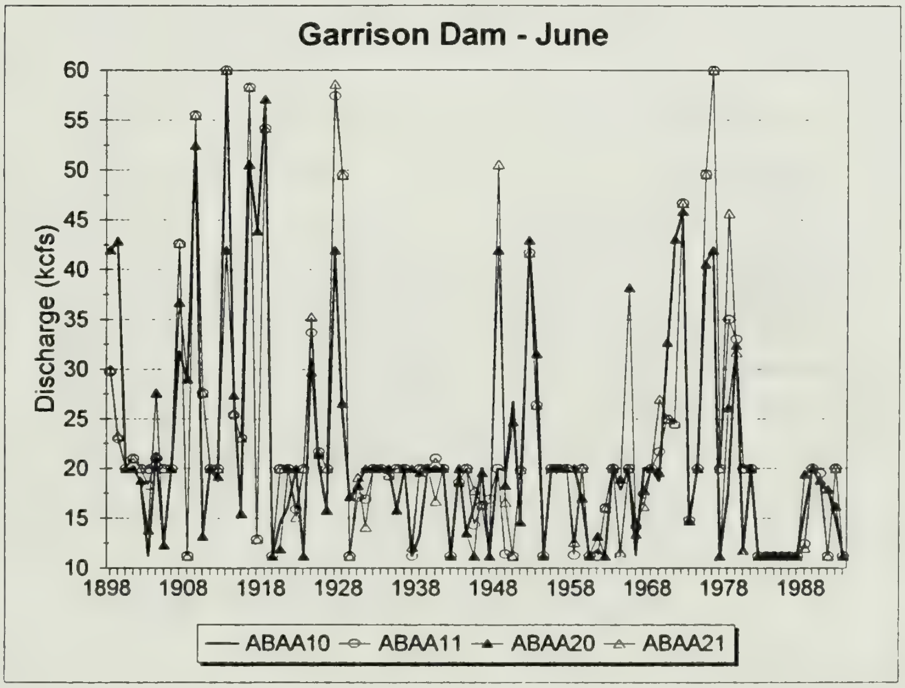

Figure 3-34. Average June water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

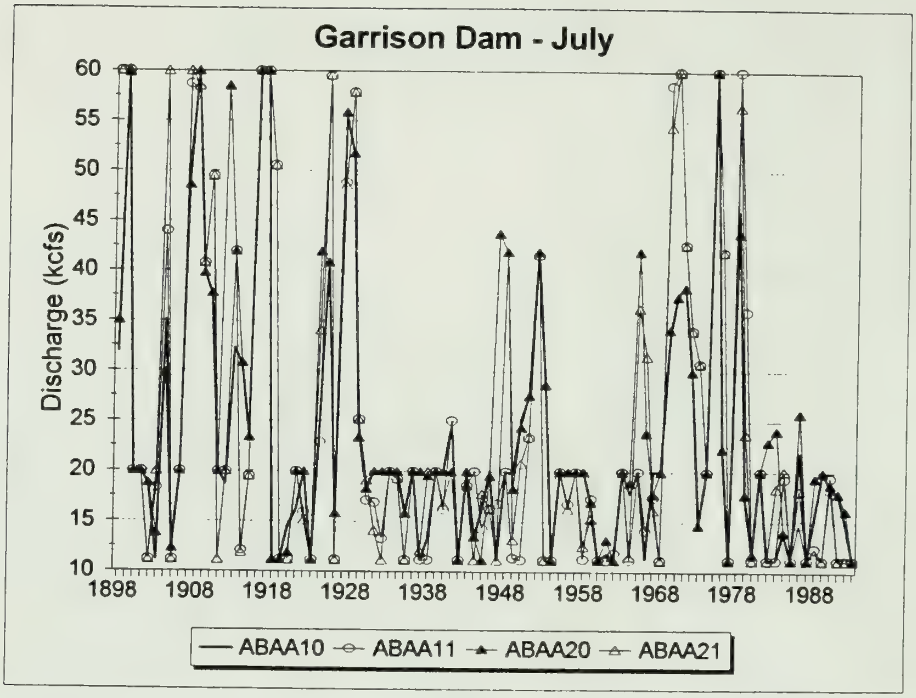

Figure 3-35. Average July water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

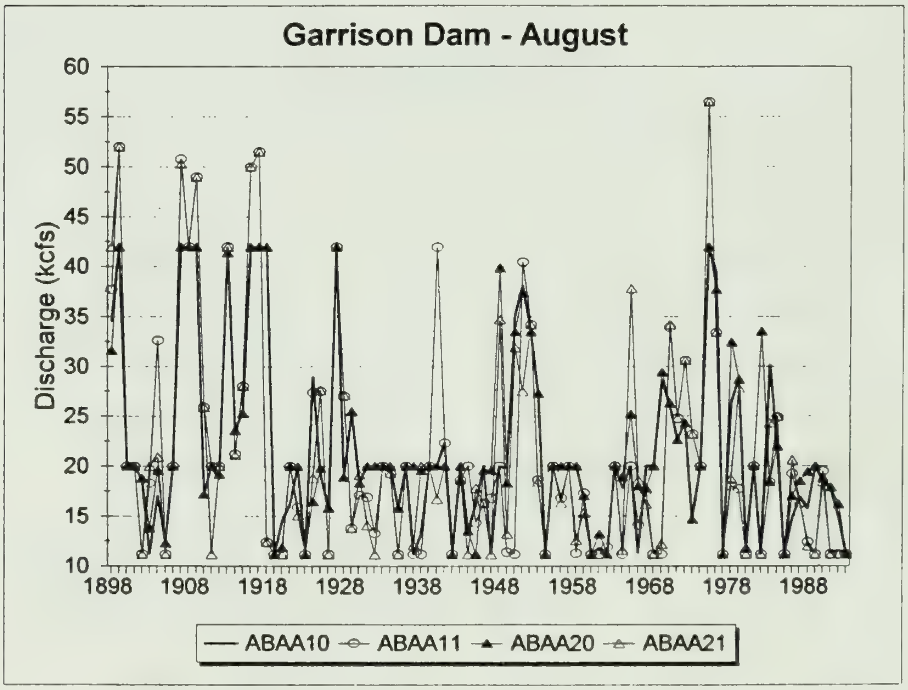

Figure 3-36. Average August water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

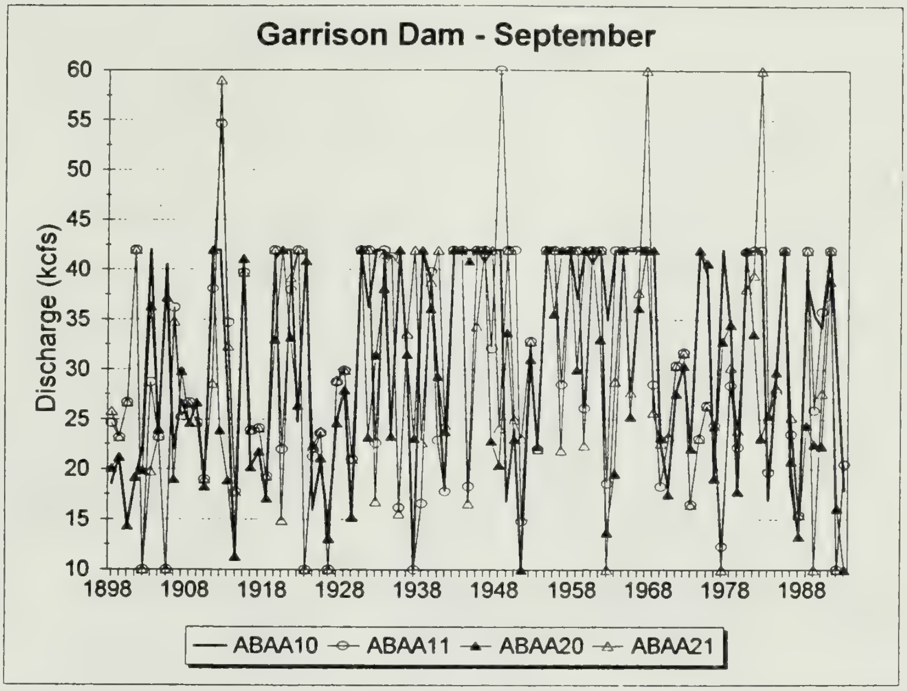

Figure 3-37. Average September water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

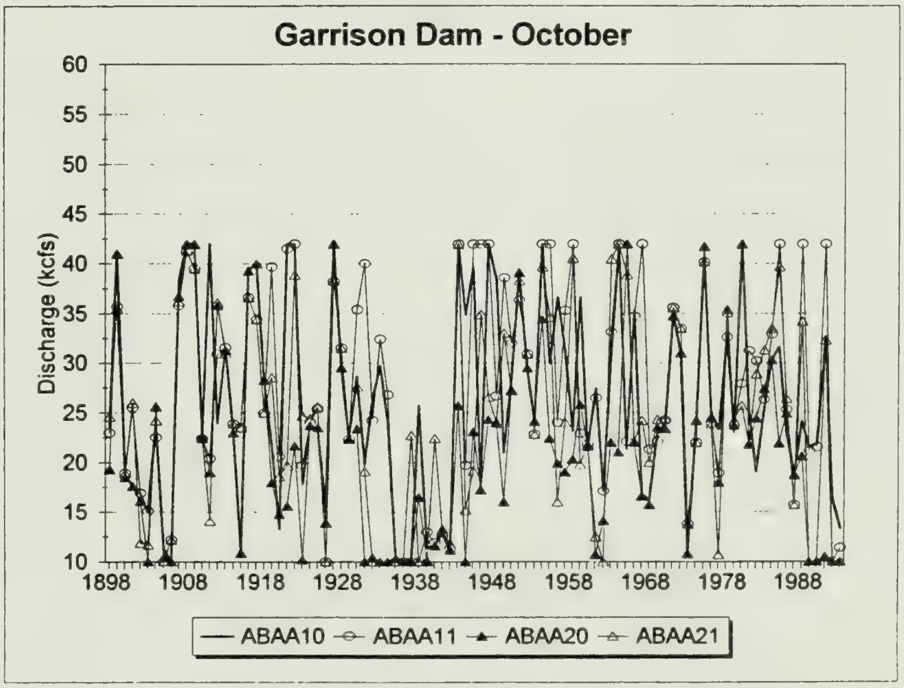

Figure 3-38. Average October water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

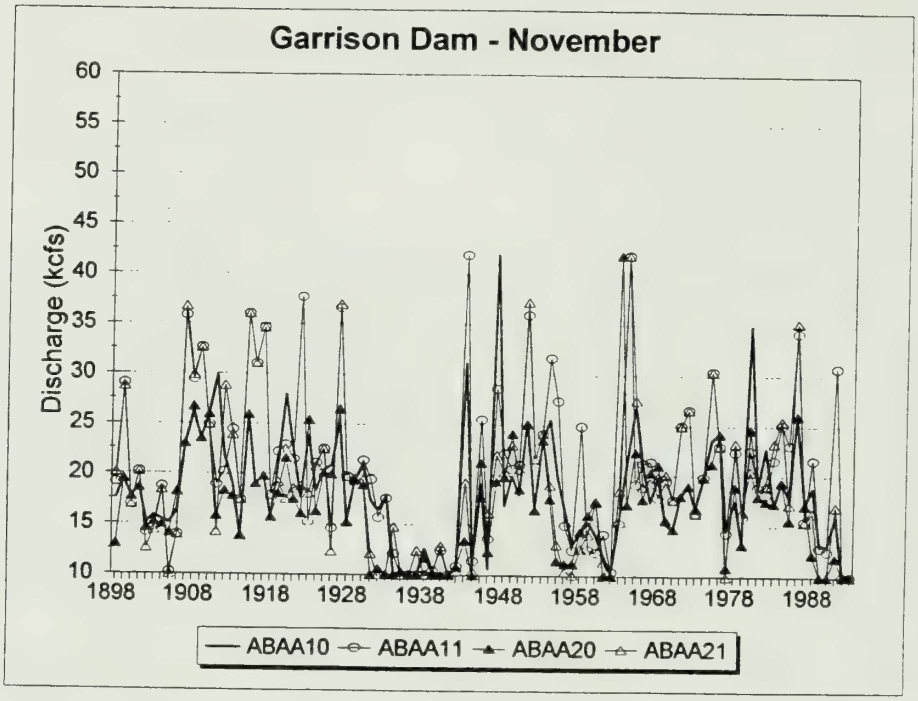

Figure 3-39. Average November water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

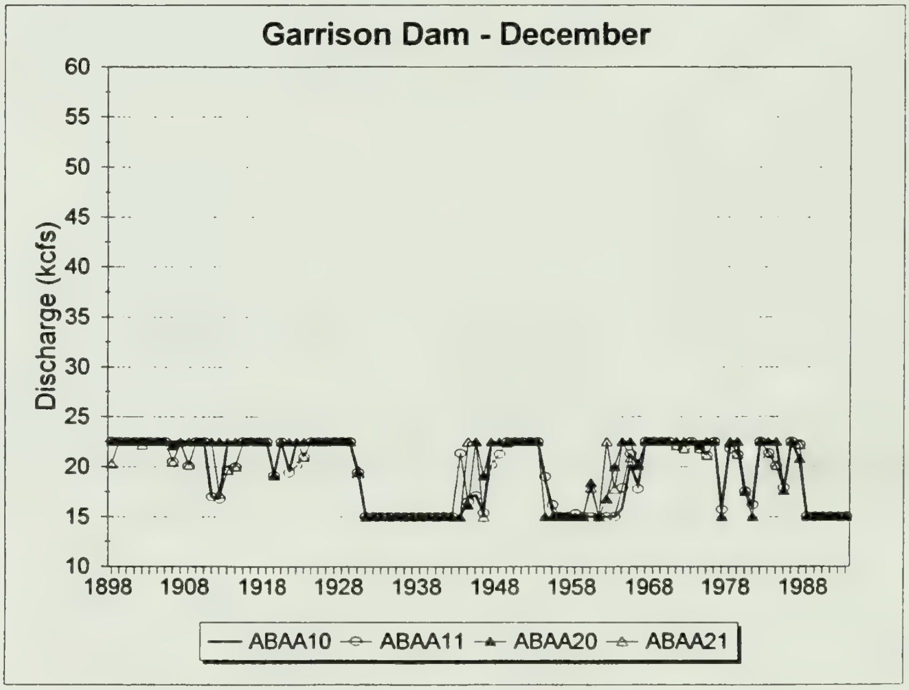

Figure 3-40. Average December water releases from Garrison Dam simulated for four alternatives (1898 to 1993).

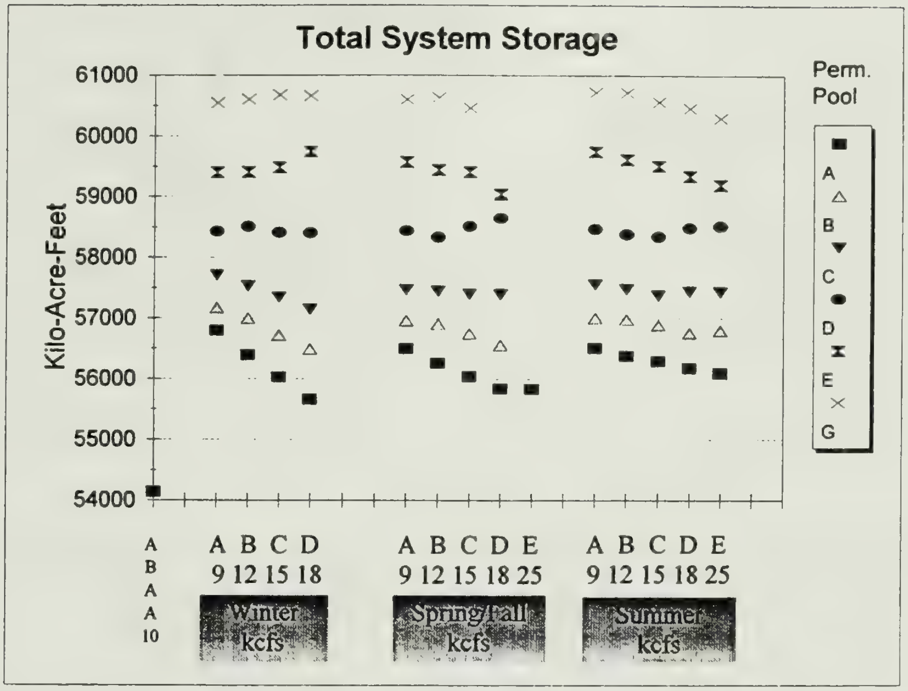

Figure 3-41. Annual average total system storage (MAF) in the six mainstem lakes over the 96-year simulation period by nonnavigation service level.

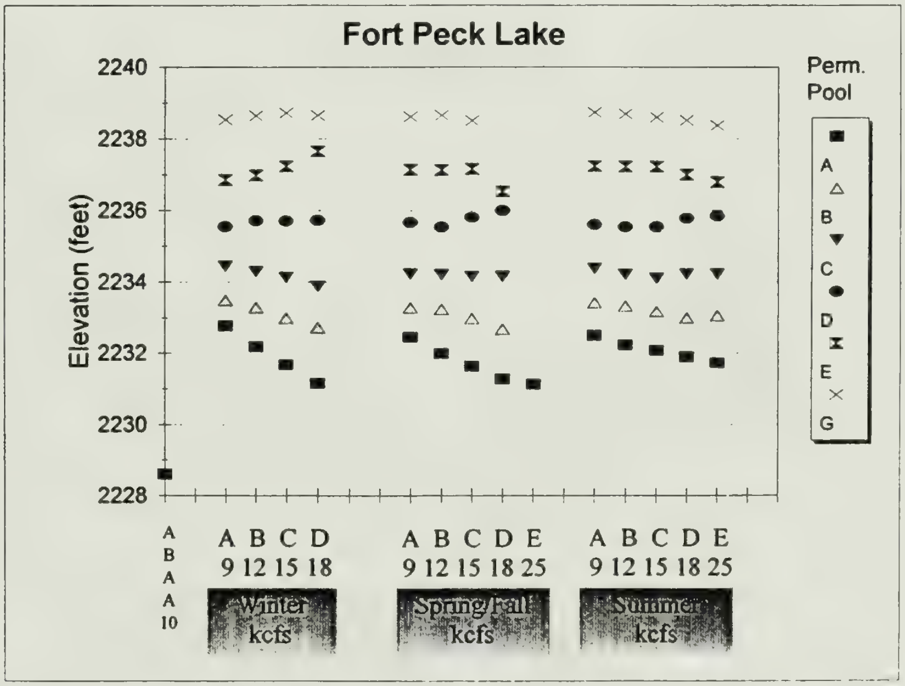

Figure 3-42. Annual average water surface elevation in Fort Peck Lake over the 96-year simulation period by nonnavigation service level.

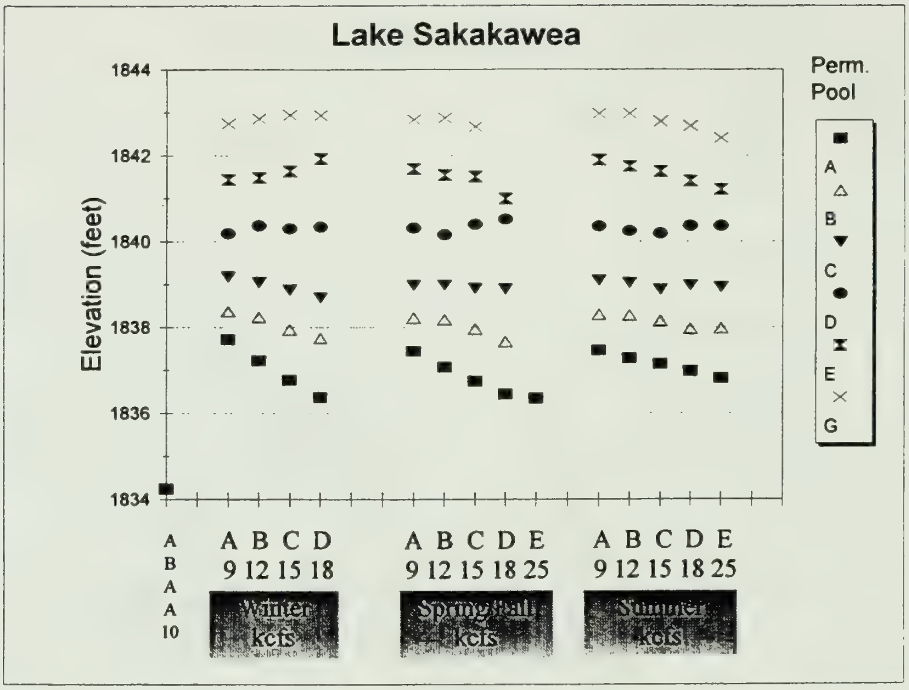

Figure 3-43. Annual average water surface elevation in Lake Sakakawea over the 96-year simulation period by nonnavigation service level.

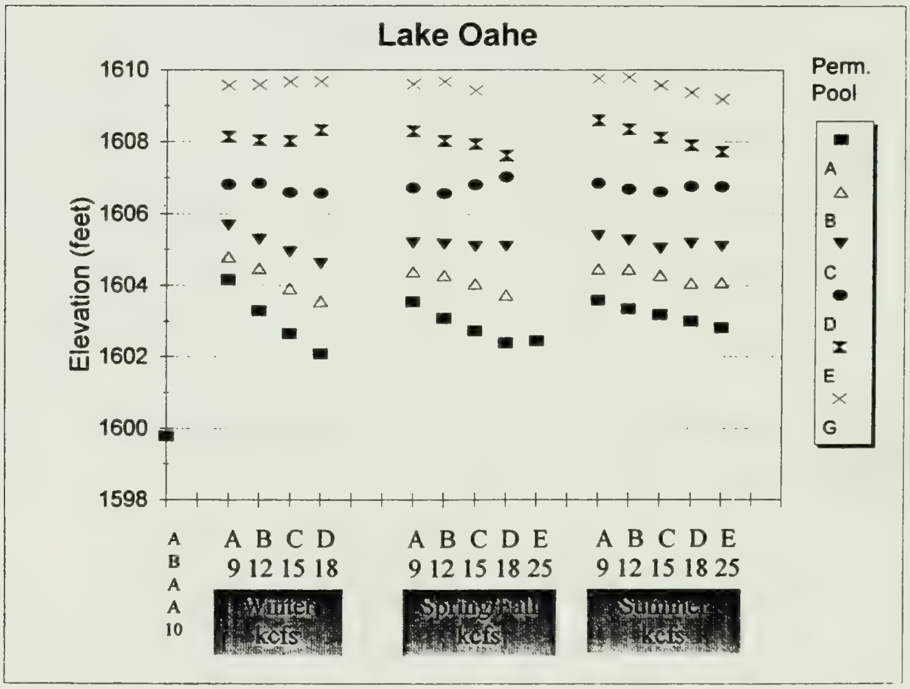

Figure 3-44. Annual average water surface elevation in Lake Oahe over the 96-year simulation period by nonnavigation service level.

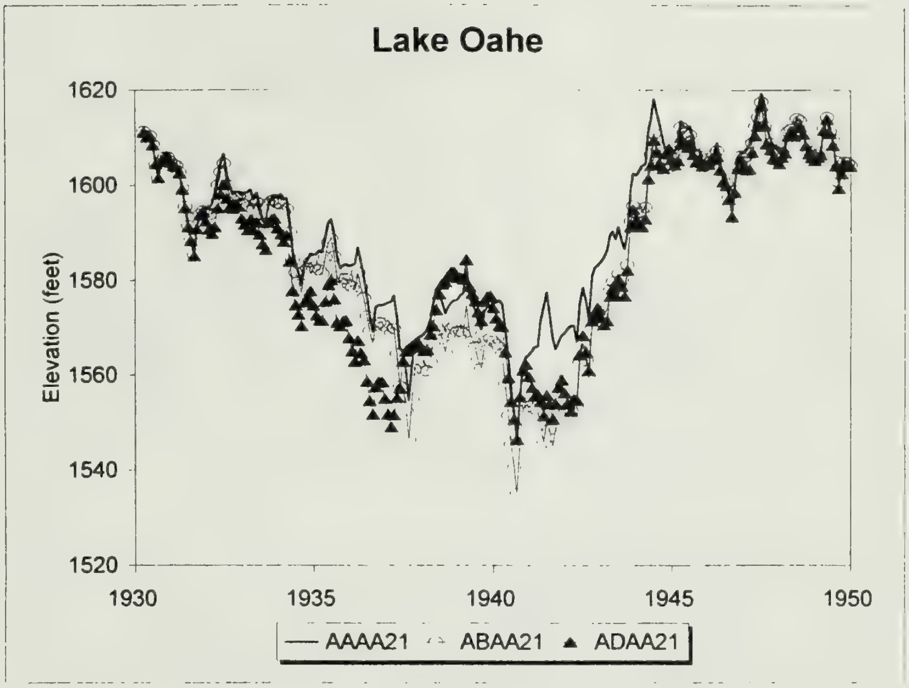

Figure 3-45. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three A-level permanent pool alternatives with different winter nonnavigation service levels.

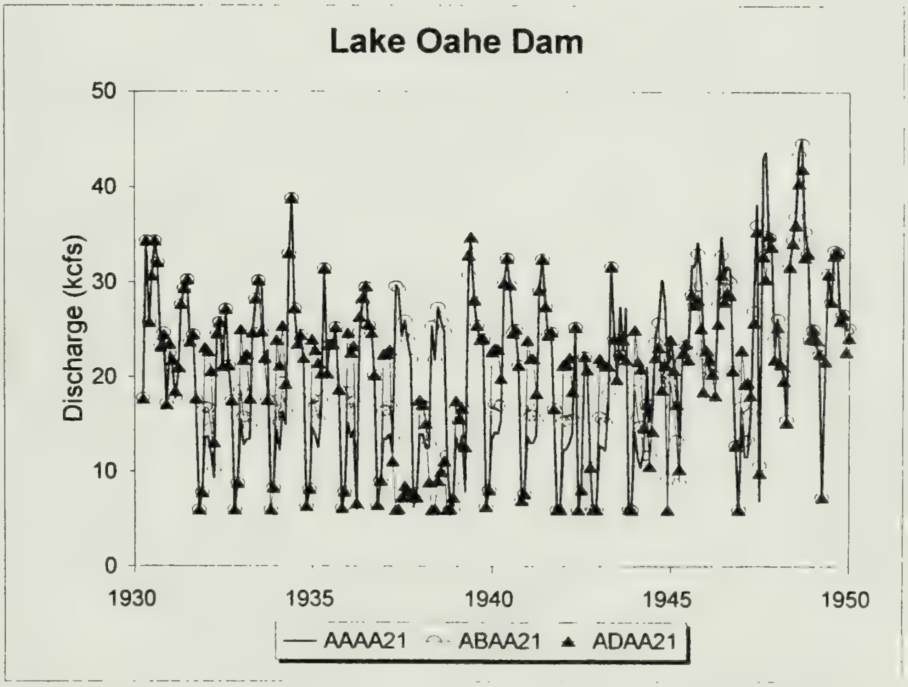

Figure 3-46. Monthly average water releases from Oahe Dam from 1930 to 1950 for three A-level permanent pool alternatives with different winter nonnavigation service levels.

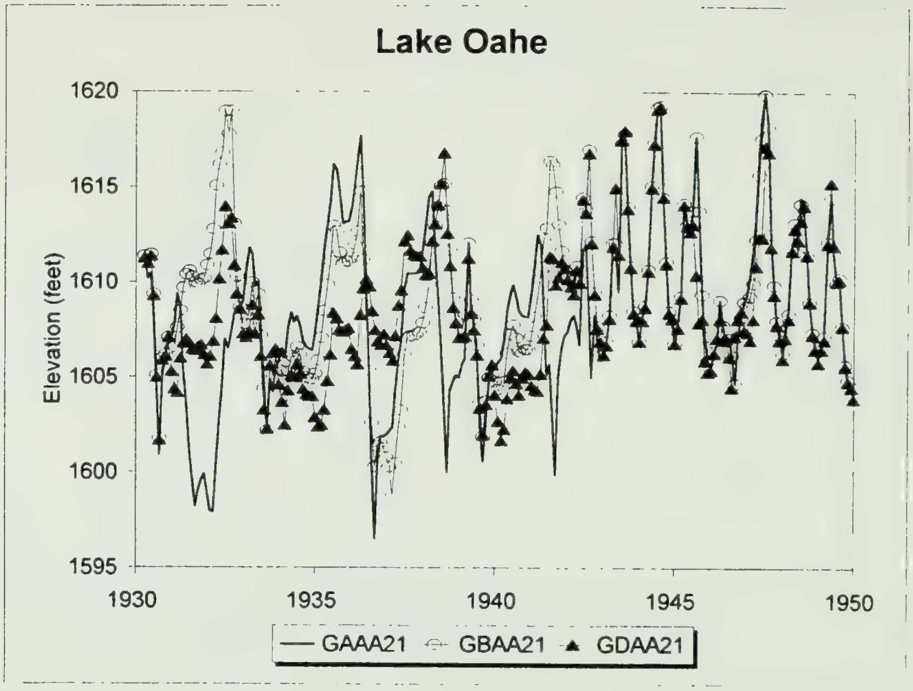

Figure 3-47. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three G-level permanent pool alternatives with different winter nonnavigation service levels.

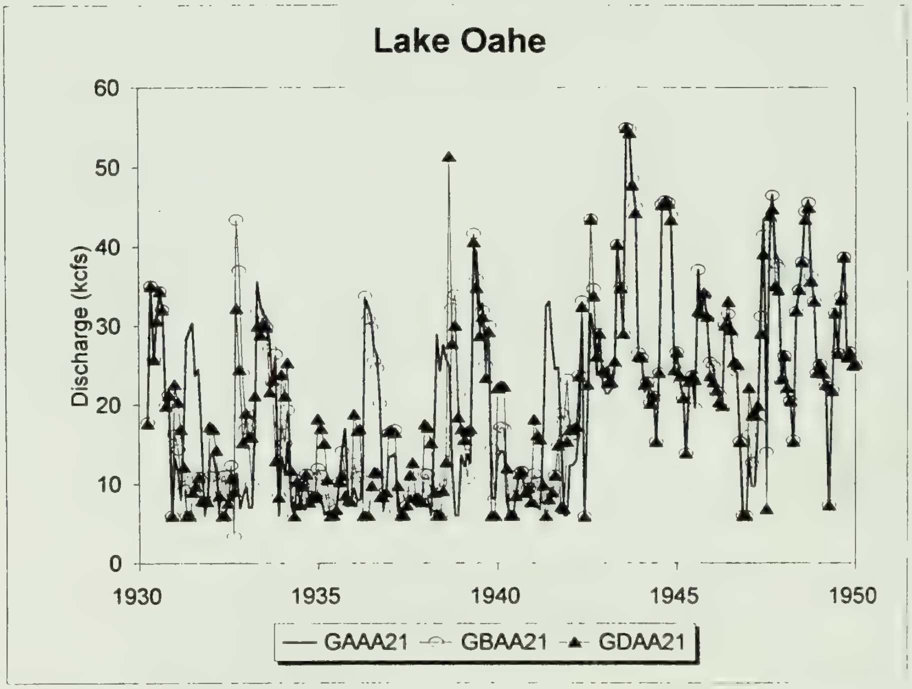

Figure 3-48. Monthly average water releases from Oahe Dam from 1930 to 1950 for three G-level permanent pool alternatives with different winter nonnavigation service levels.

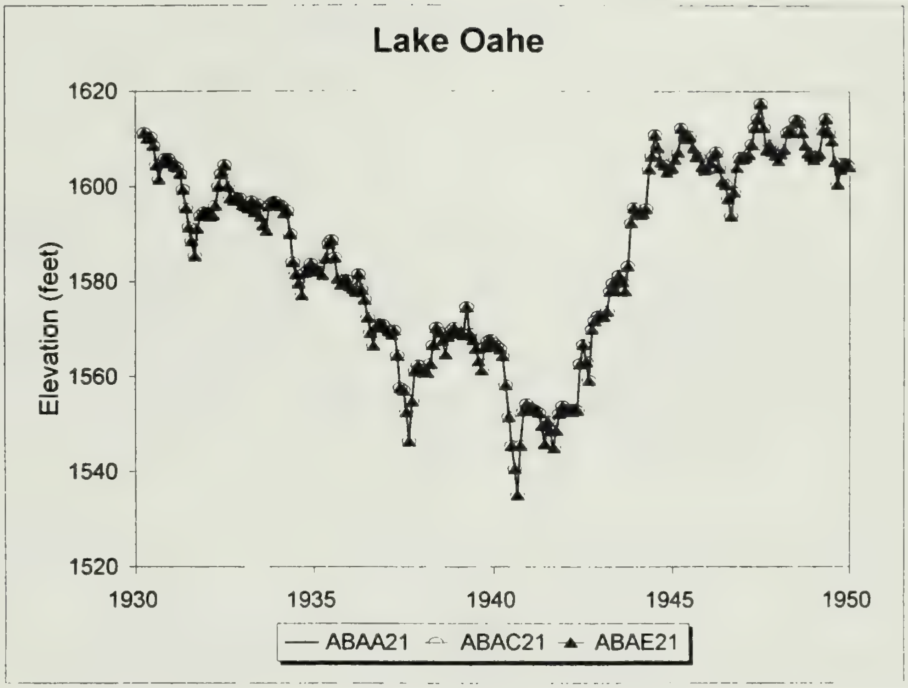

Figure 3-49. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three A-level permanent pool alternatives with different summer nonnavigation service levels.

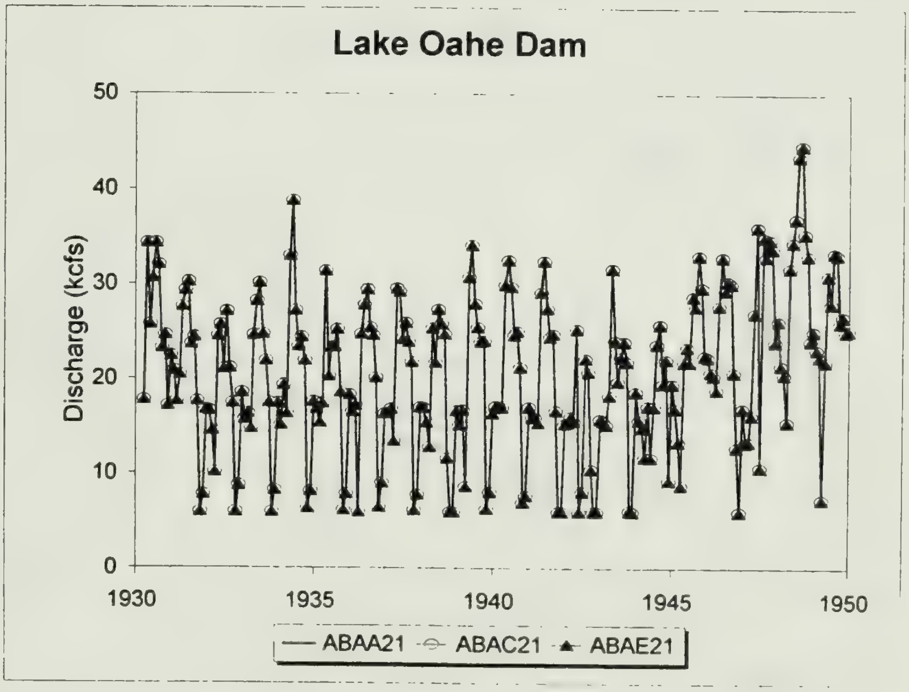

Figure 3-50. Monthly average water releases from Oahe Dam from 1930 to 1950 for three A-level permanent pool alternatives with different summer nonnavigation service levels.

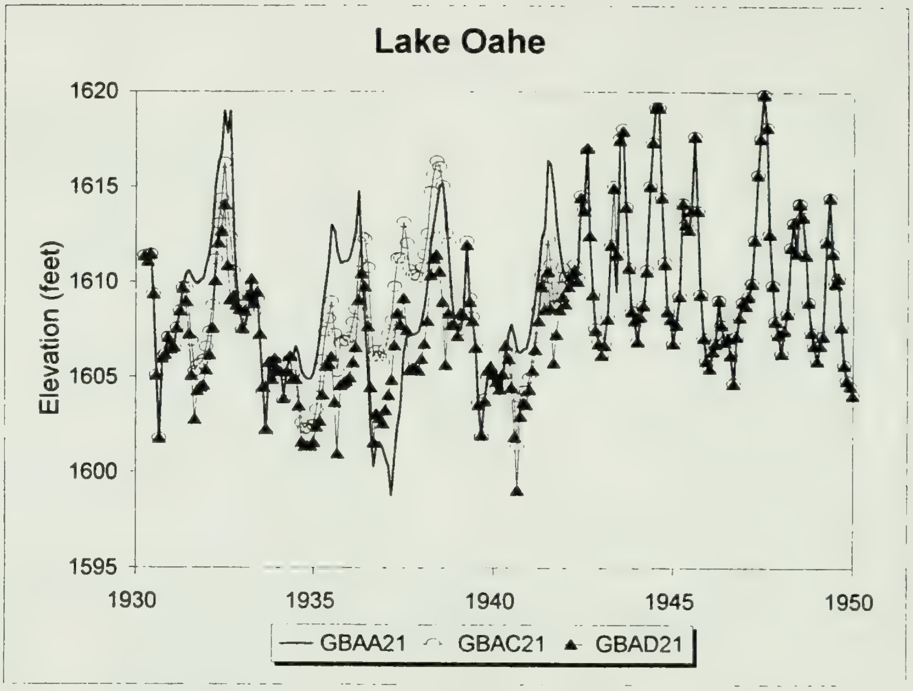

Figure 3-51. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three G-level permanent pool alternatives with different summer nonnavigation service levels.

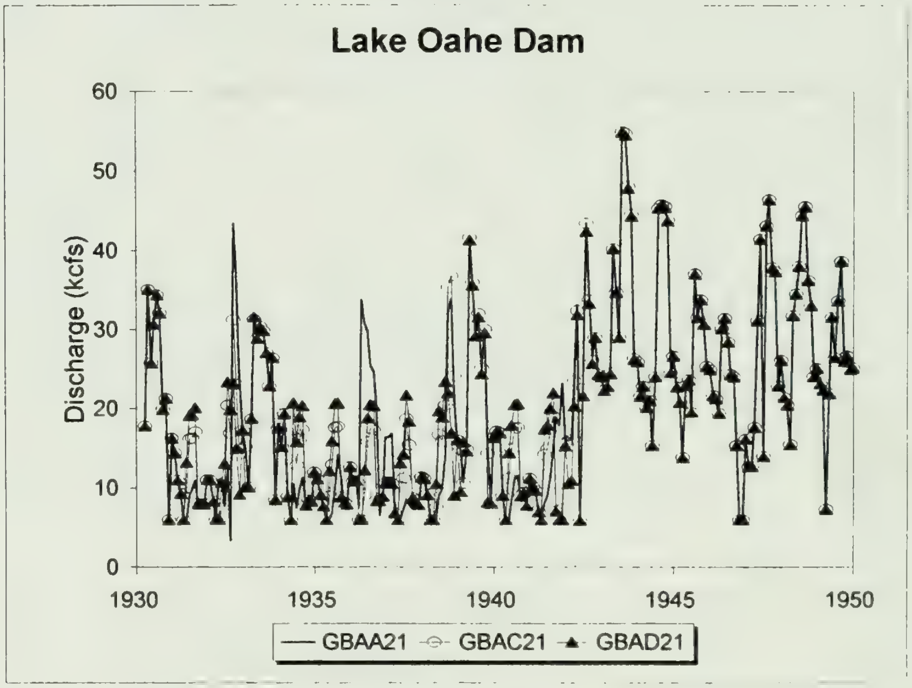

Figure 3-52. Monthly average water releases from Oahe Dam from 1930 to 1950 for three G-level permanent pool alternatives with different summer nonnavigation service levels.

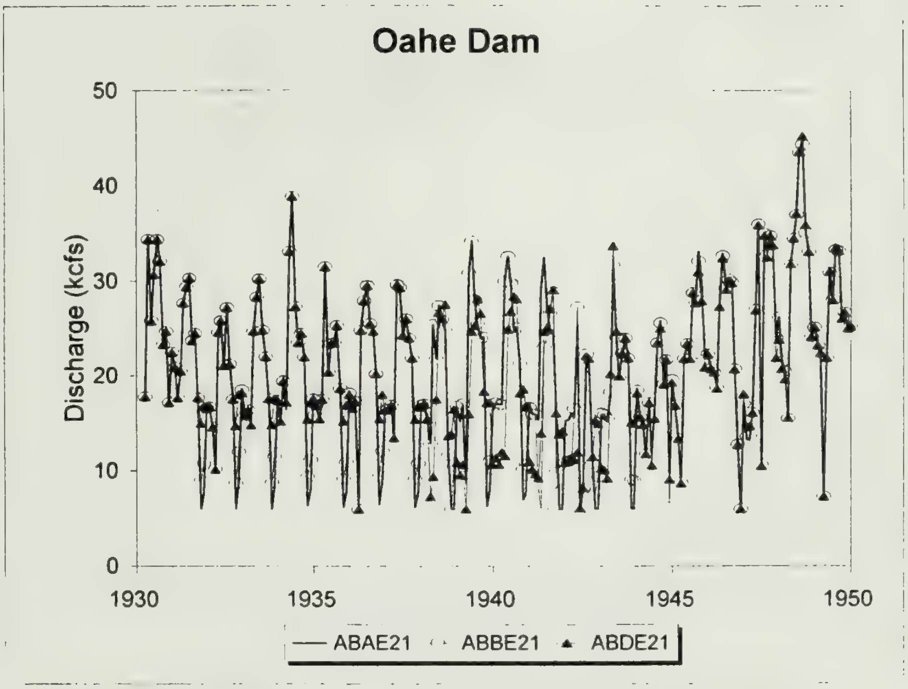

Figure 3-53. Monthly average water releases from Oahe Dam from 1930 to 1950 for three A-level permanent pool alternatives with different spring-fall nonnavigation service levels.

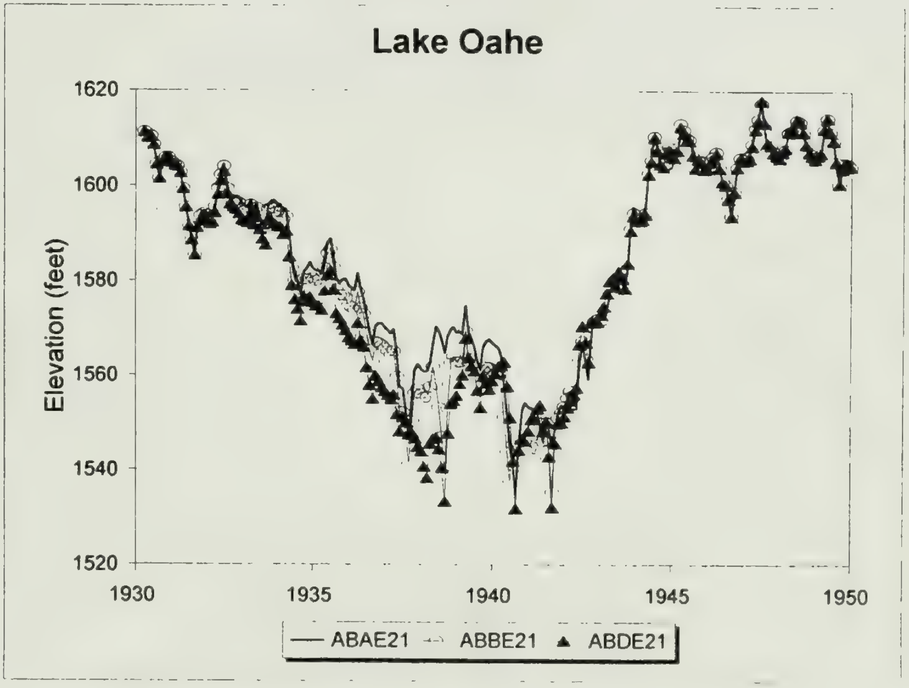

Figure 3-54. Monthly average water surface elevations in Lake Oahe from 1930 to 1950 for three A-level permanent pool alternatives with different spring-fall nonnavigation service levels.

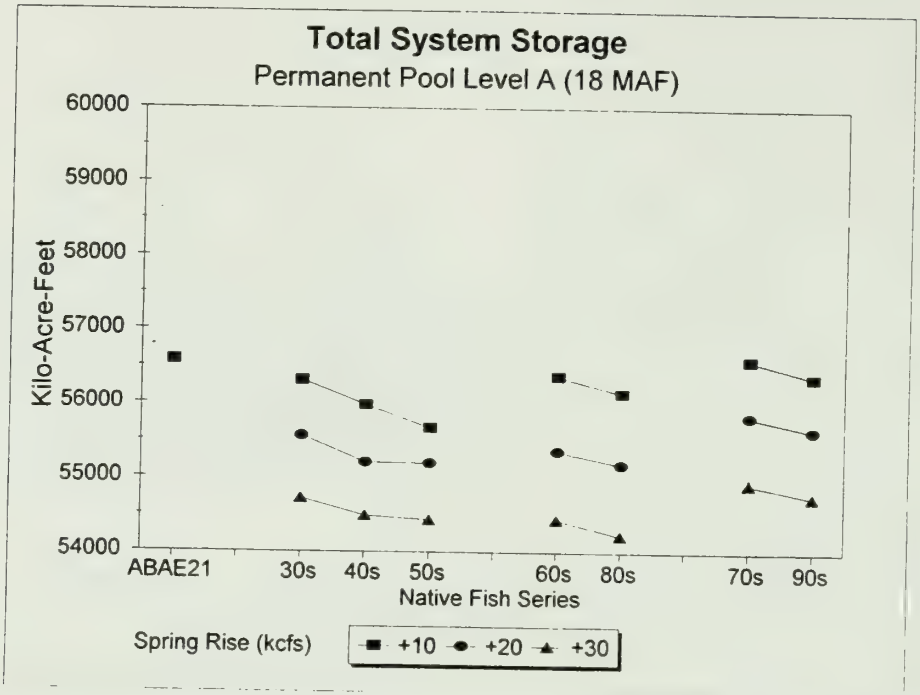

Figure 3-55. Average annual total system storage (KAF) for A-pool Native Fish alternatives over the 96-year simulation period.

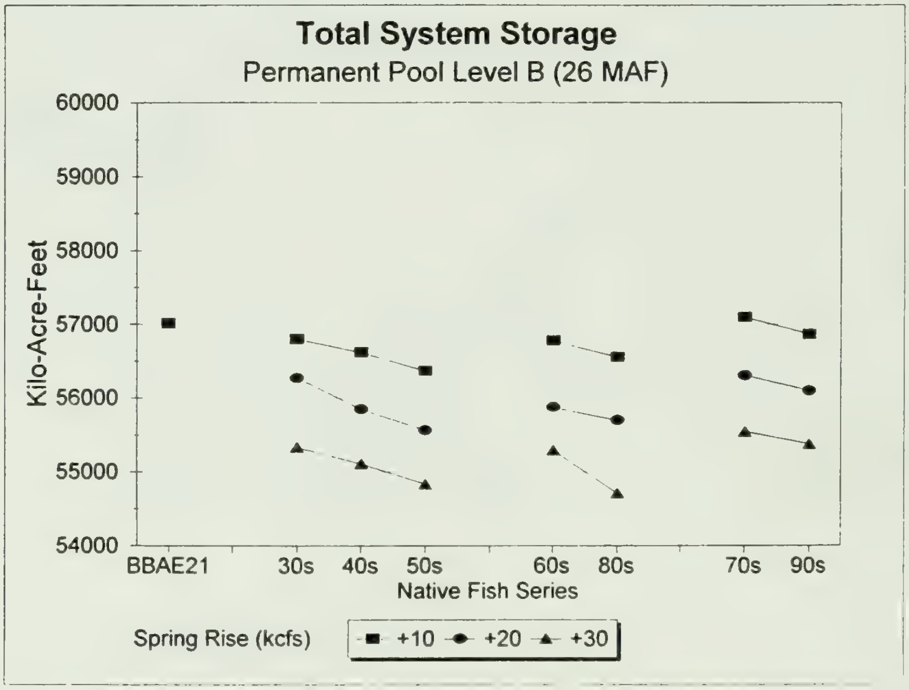

Figure 3-56. Average annual total system storage (KAF) for B-pool Native Fish alternatives over the 96-year simulation period.

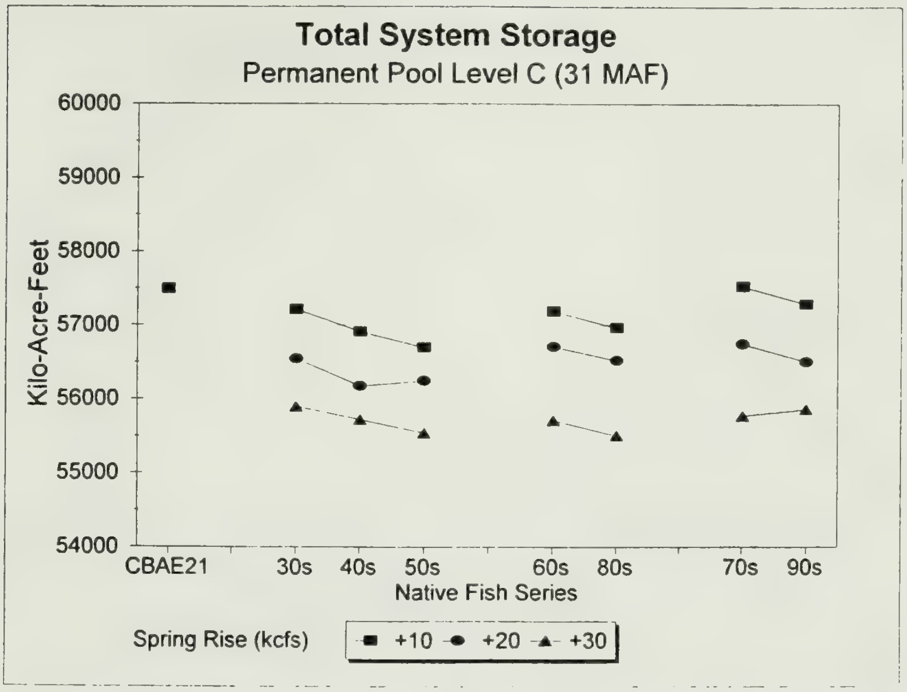

Figure 3-57. Average annual total system storage (KAF) for C-pool Native Fish alternatives over the 96-year simulation period.

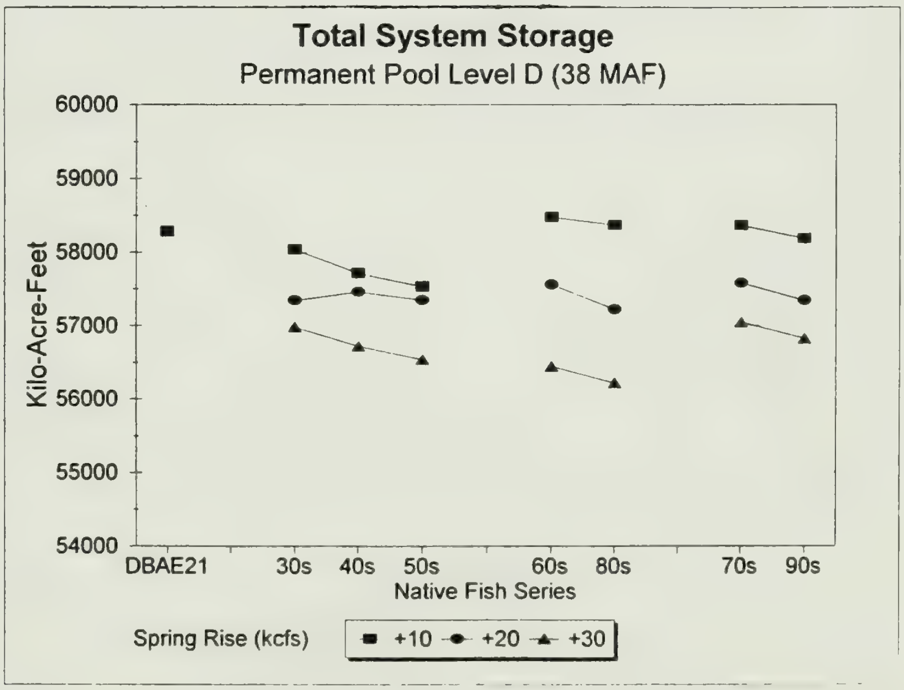

Figure 3-58. Average annual total system storage (KAF) for D-pool Native Fish alternatives over the 96-year simulation period.

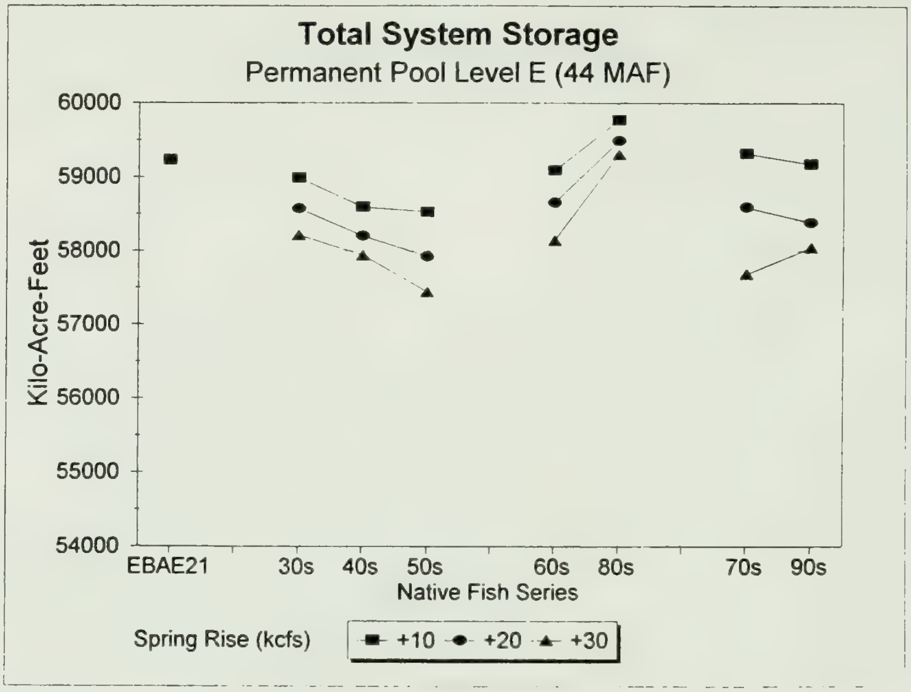

Figure 3-59. Average annual total system storage (KAF) for E-pool Native Fish alternatives over the 96-year simulation period.

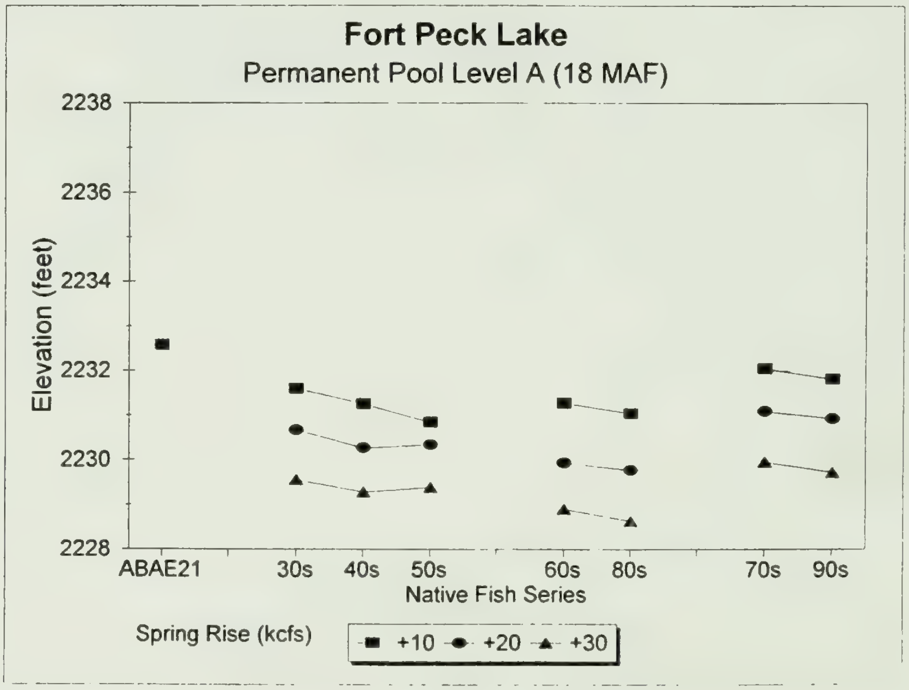

Figure 3-60. Average annual water surface elevation in Fort Peck Lake for A-pool Native Fish alternatives over the 96-year simulation period.

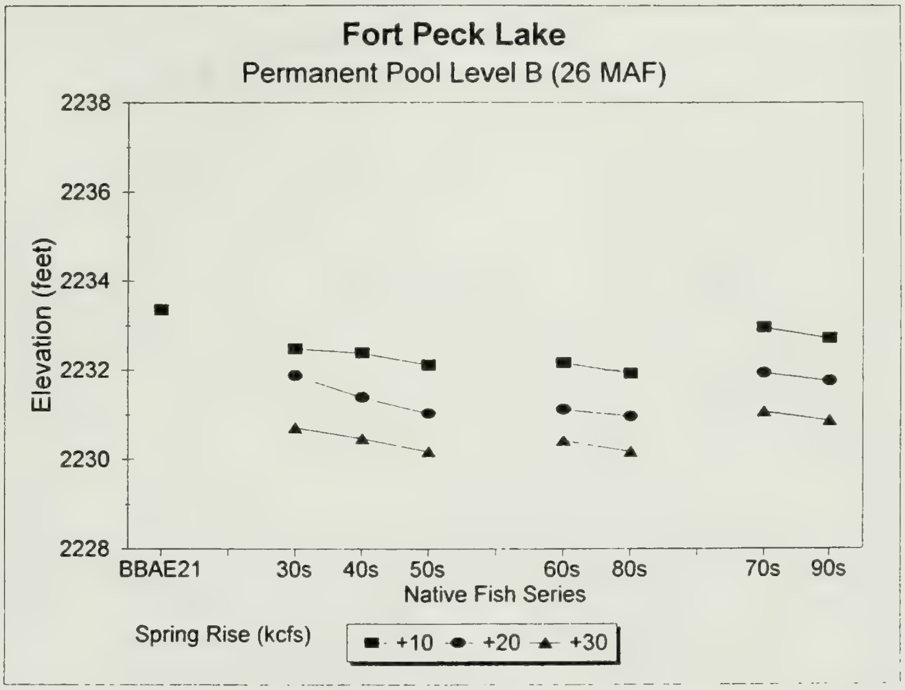

Figure 3-61. Average annual water surface elevation in Fort Peck Lake for B-pool Native Fish alternatives over the 96-year simulation period.

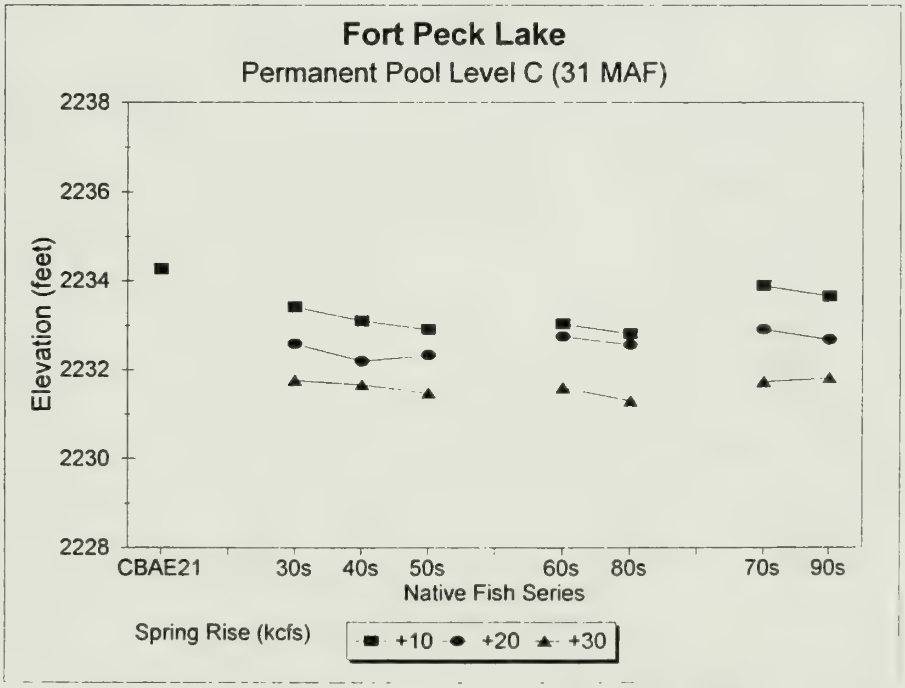

Figure 3-62. Average annual water surface elevation in Fort Peck Lake for C-pool Native Fish alternatives over the 96-year simulation period.

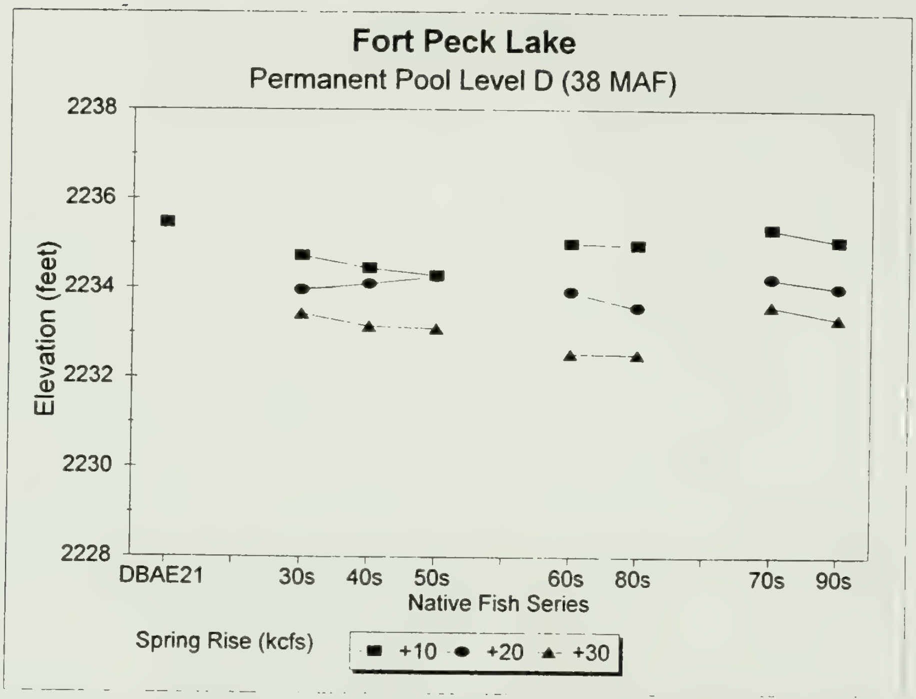

Figure 3-63. Average annual water surface elevation in Fort Peck Lake for D-pool Native Fish alternatives over the 96-year simulation period.

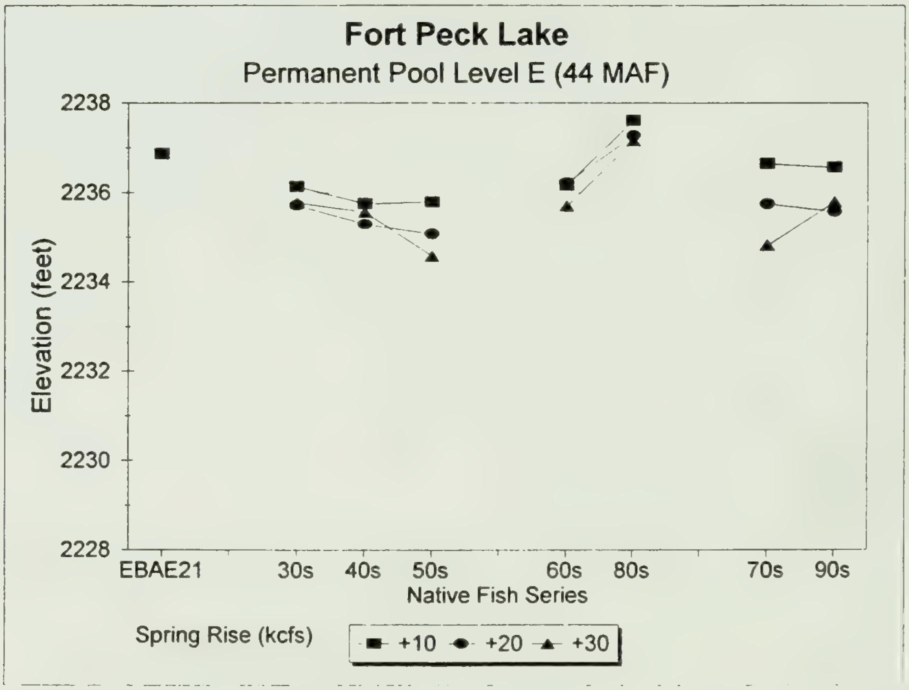

Figure 3-64. Average annual water surface elevation in Fort Peck Lake for E-pool Native Fish alternatives over the 96-year simulation period.

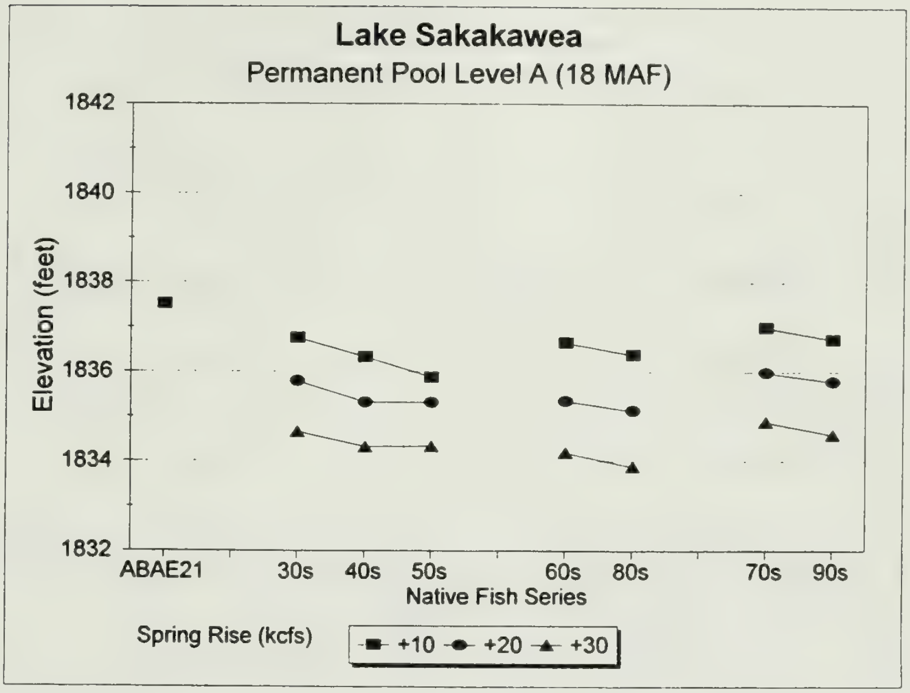

Figure 3-65. Average annual water surface elevation in Lake Sakakawea for A-pool Native Fish alternatives over the 96-year simulation period.

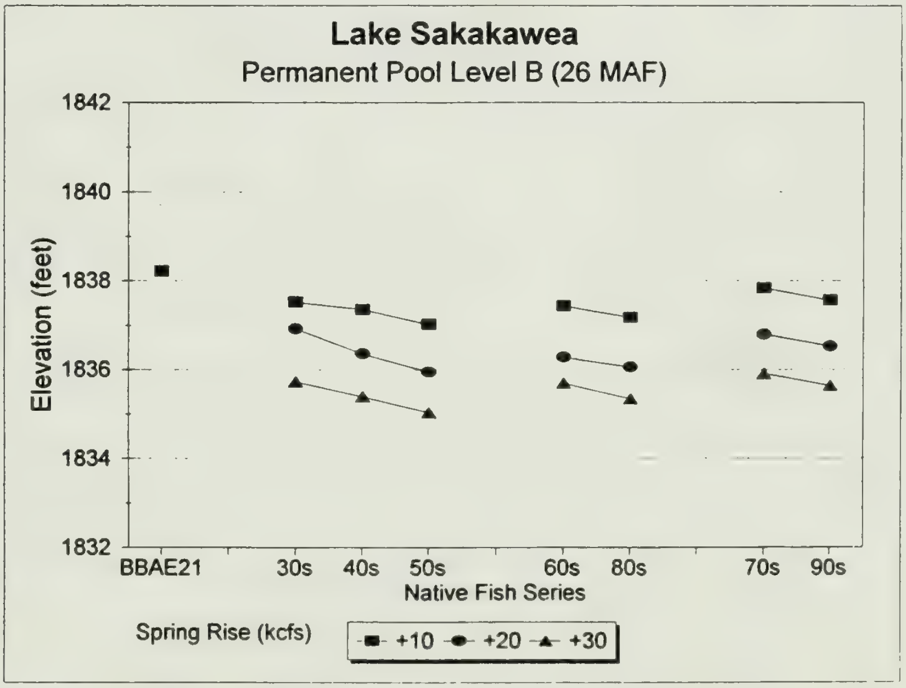

Figure 3-66. Average annual water surface elevation in Lake Sakakawea for B-pool Native Fish alternatives over the 96-year simulation period.

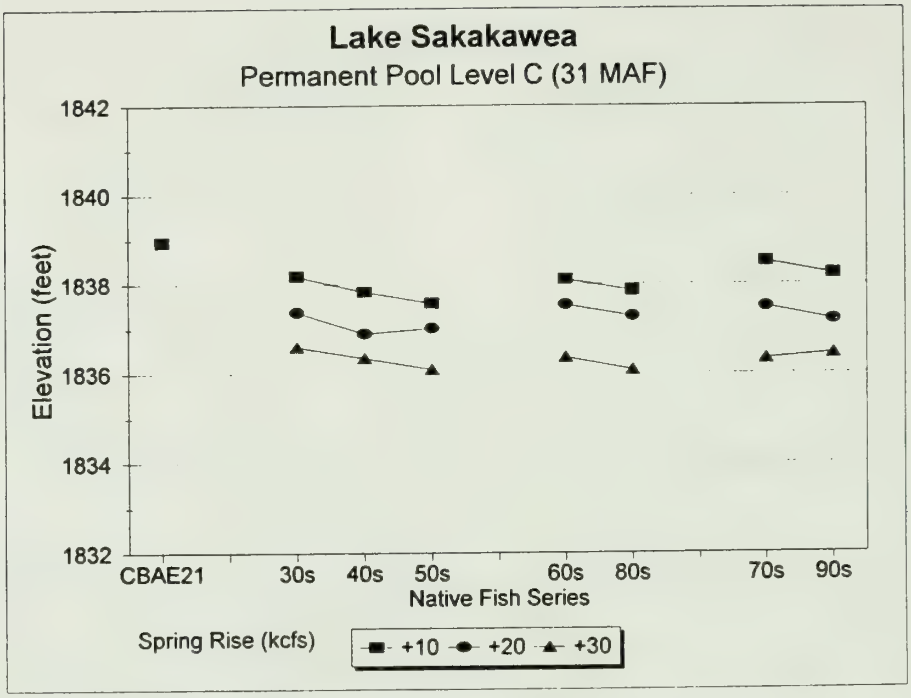

Figure 3-67. Average annual water surface elevation in Lake Sakakawea for C-pool Native Fish alternatives over the 96-year simulation period.

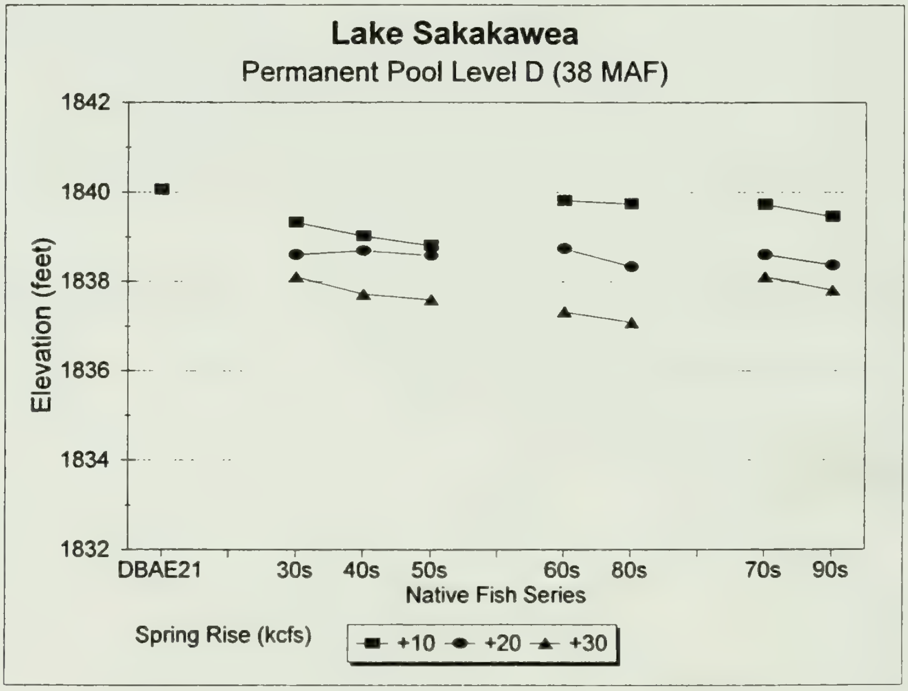

Figure 3-68. Average annual water surface elevation in Lake Sakakawea for D-pool Native Fish alternatives over the 96-year simulation period.

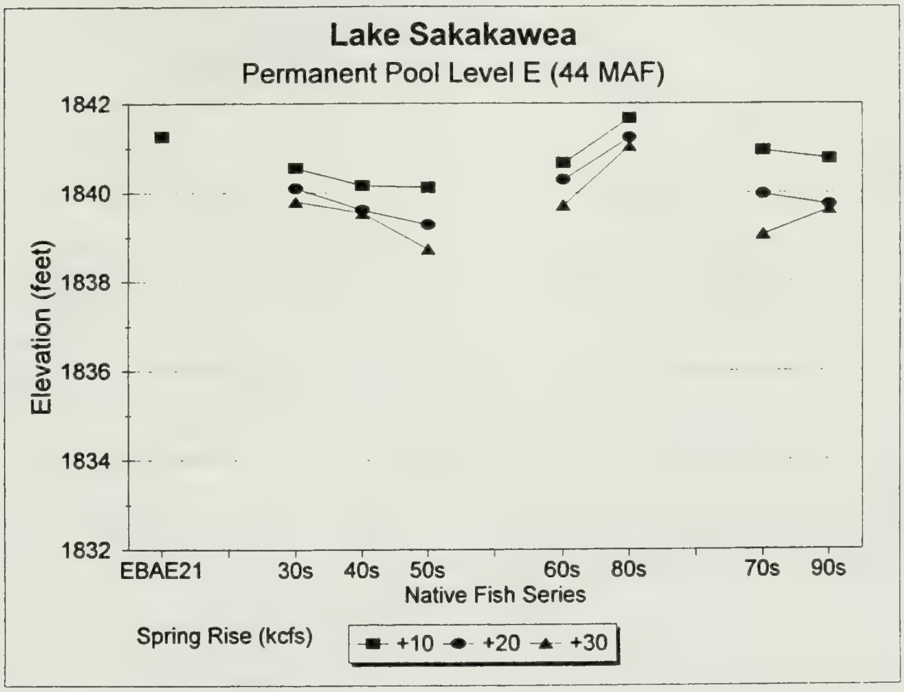

Figure 3-69. Average annual water surface elevation in Lake Sakakawea for E-pool Native Fish alternatives over the 96-year simulation period.

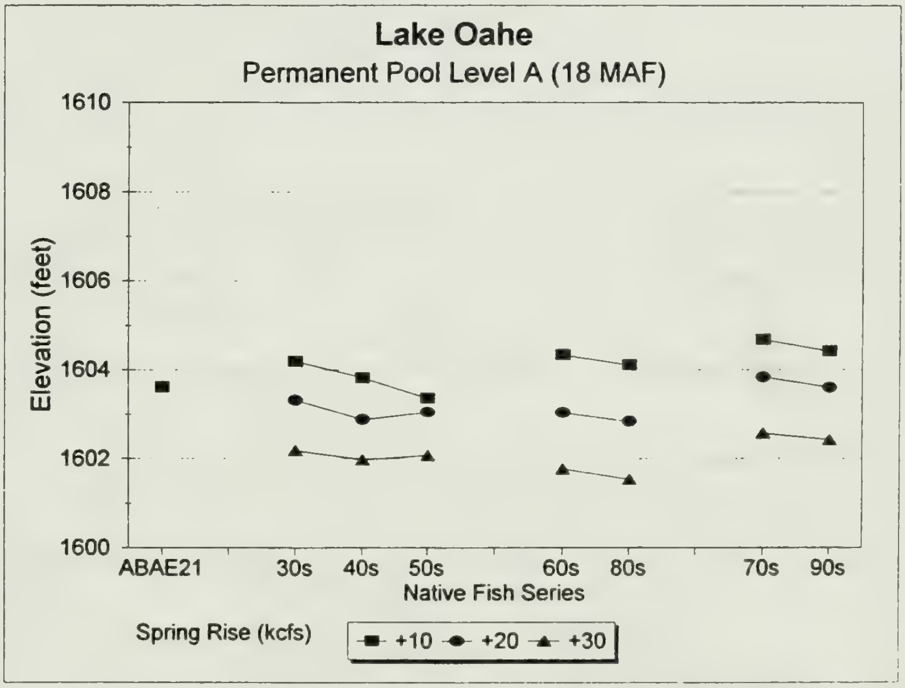

Figure 3-70. Average annual water surface elevation in Lake Oahe for A-pool Native Fish alternatives over the 96-year simulation period.

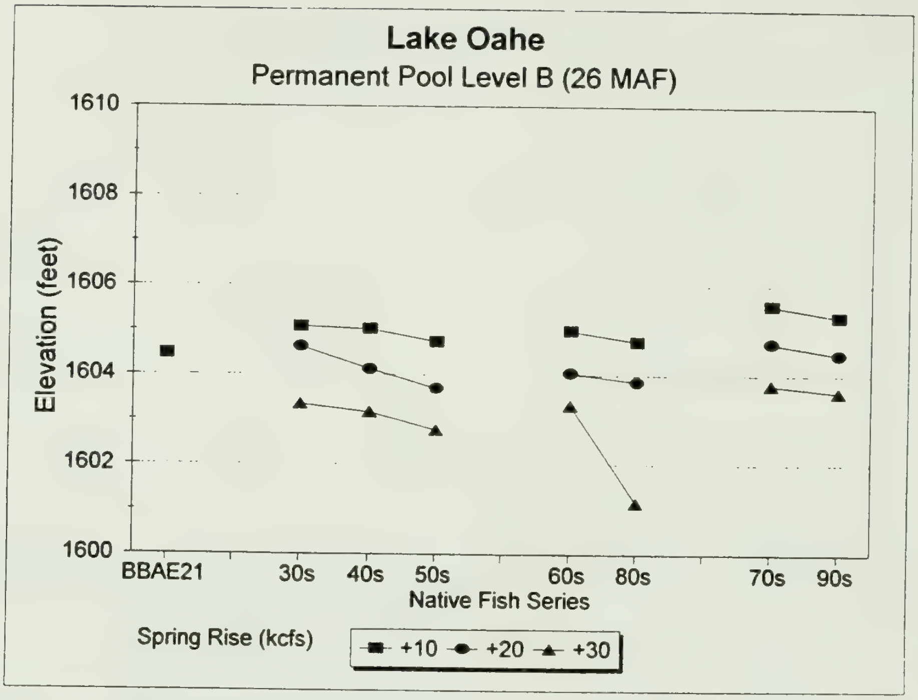

Figure 3-71. Average annual water surface elevation in Lake Oahe for B-pool Native Fish alternatives over the 96-year simulation period.

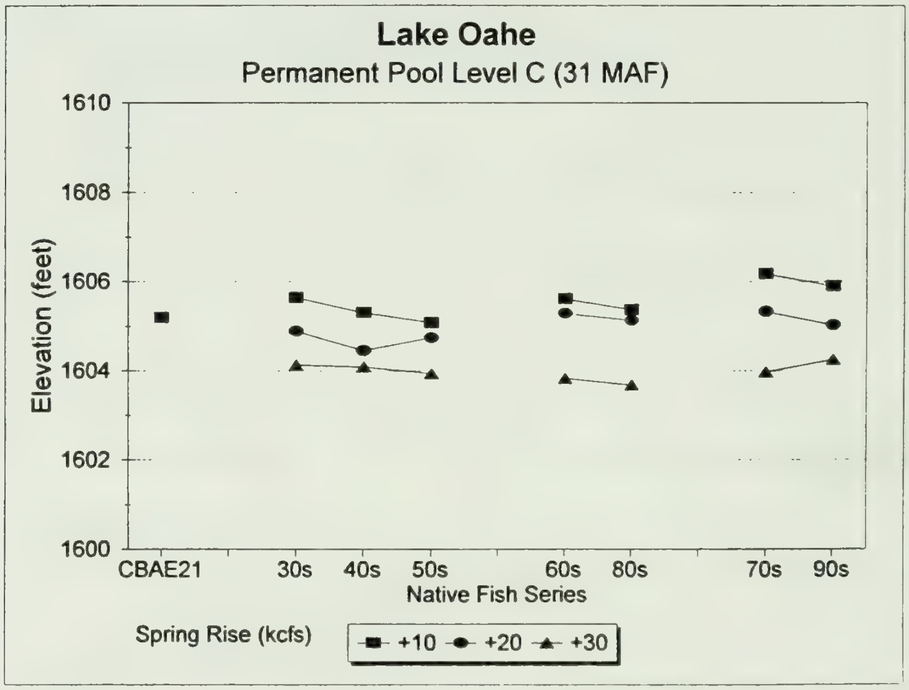

Figure 3-72. Average annual water surface elevation in Lake Oahe for C-pool Native Fish alternatives over the 96-year simulation period.

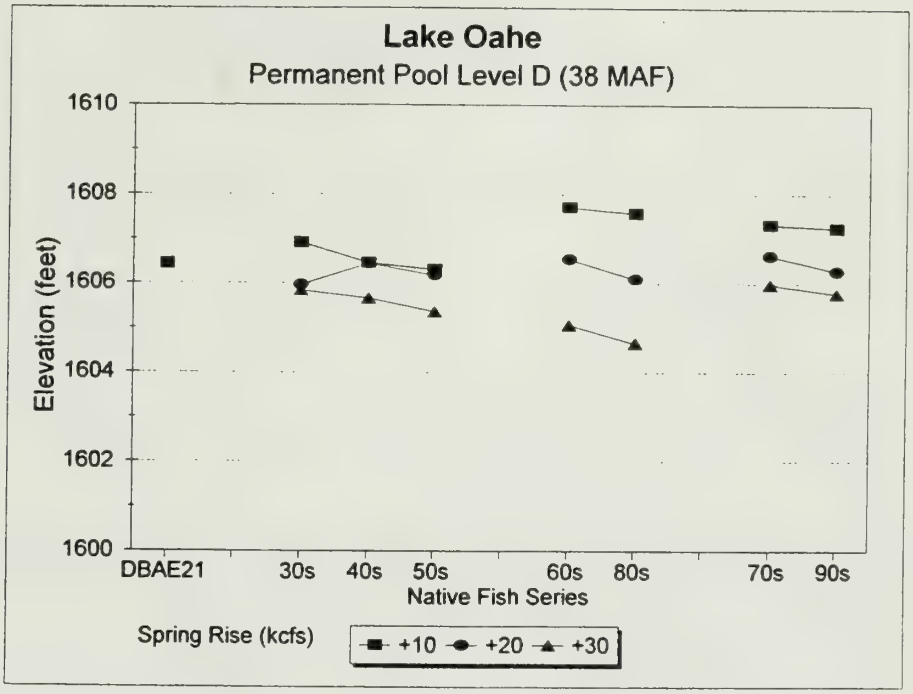

Figure 3-73. Average annual water surface elevation in Lake Oahe for D-pool Native Fish alternatives over the 96-year simulation period.

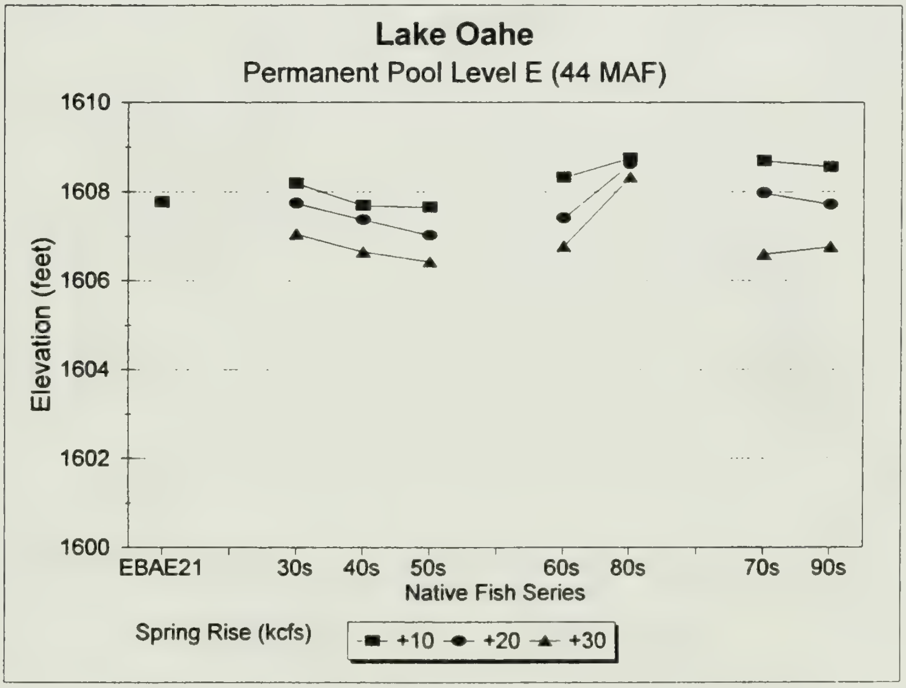

Figure 3-74. Average annual water surface elevation in Lake Oahe for E-pool Native Fish alternatives over the 96-year simulation period.

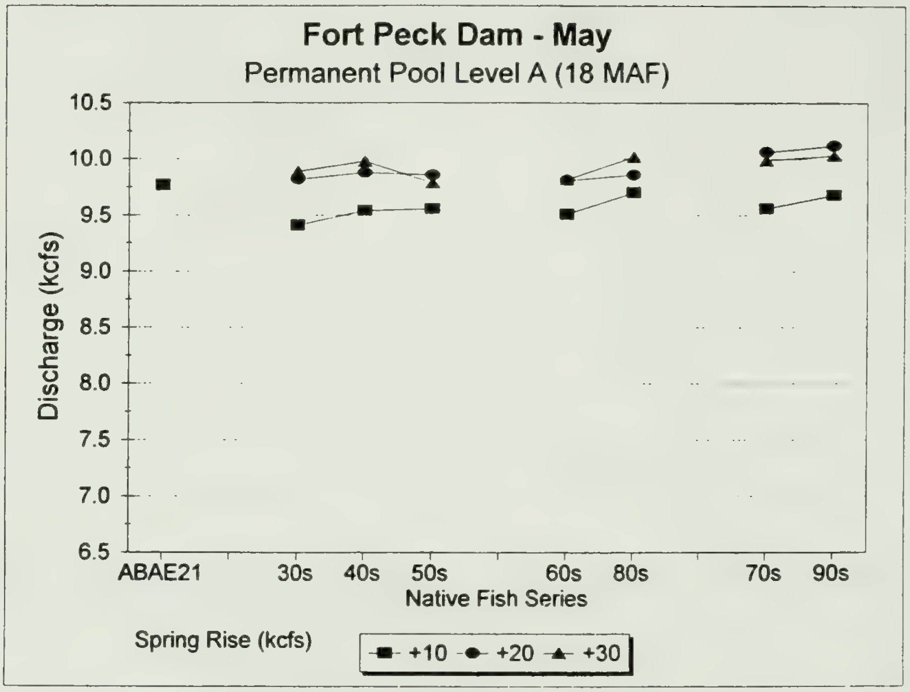

Figure 3-75. Average May water releases from Fort Peck Dam for A-pool Native Fish alternatives over the 96-year simulation period.

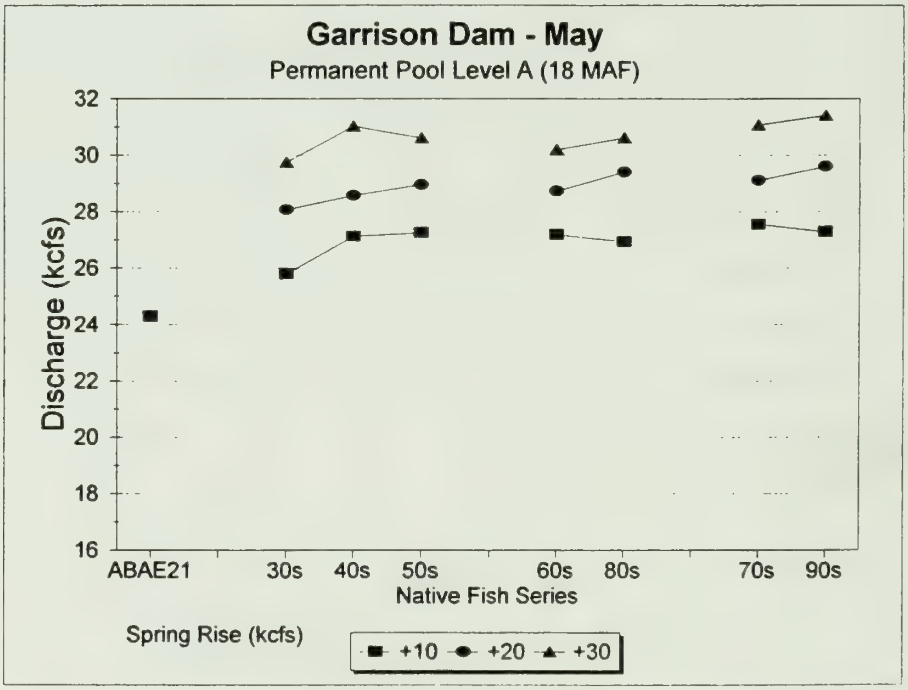

Figure 3-76. Average May water releases from Garrison Dam for A-pool Native Fish alternatives over the 96-year simulation period.

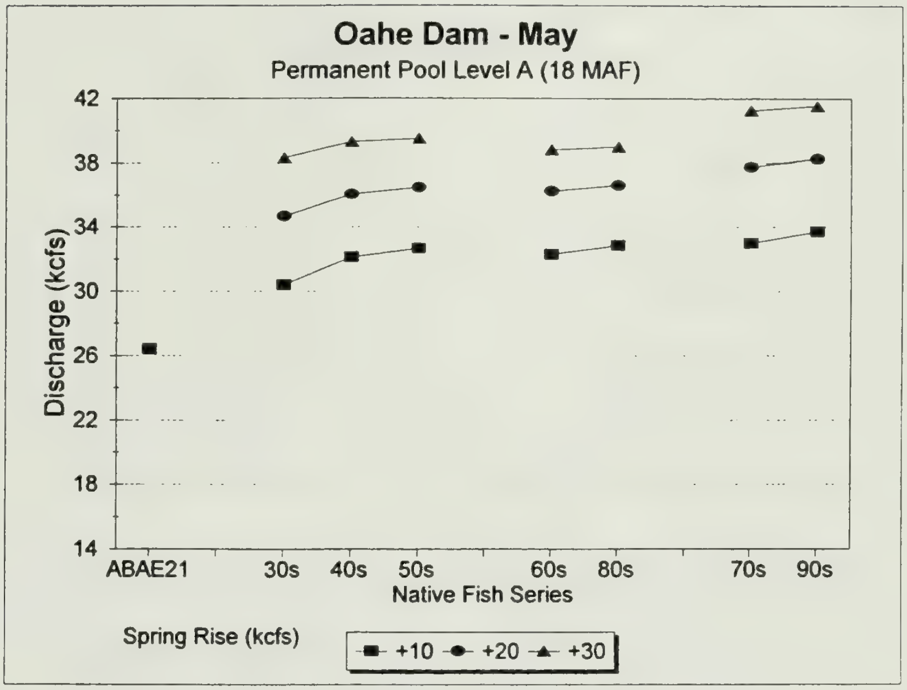

Figure 3-77. Average May water releases from Oahe Dam for A-pool Native Fish alternatives over the 96-year simulation period.

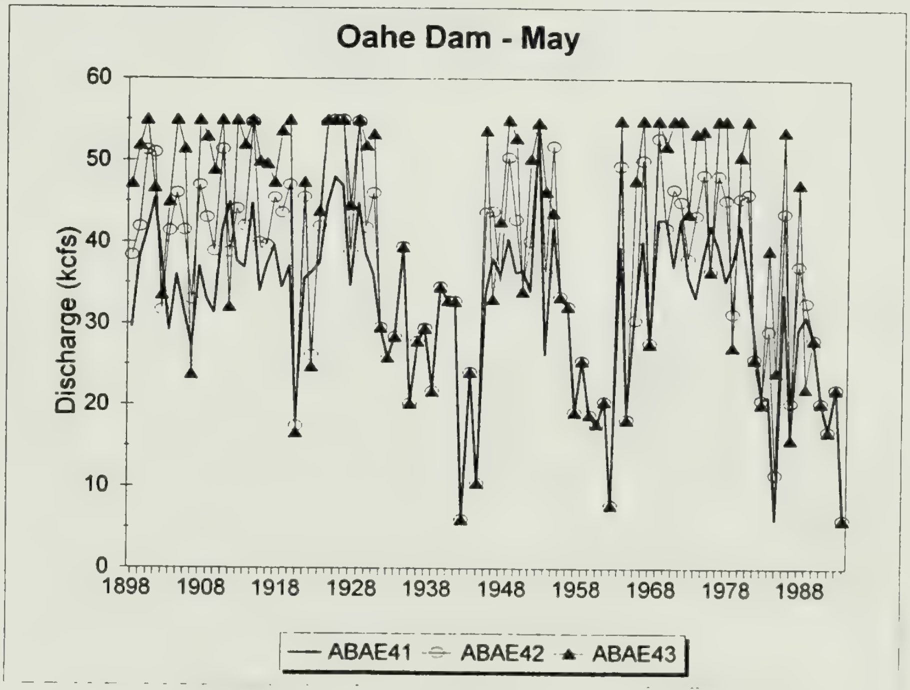

Figure 3-78. Average monthly water releases for month of May from Oahe Dam over the 96-year simulation period for three alternatives with three different spring service levels.

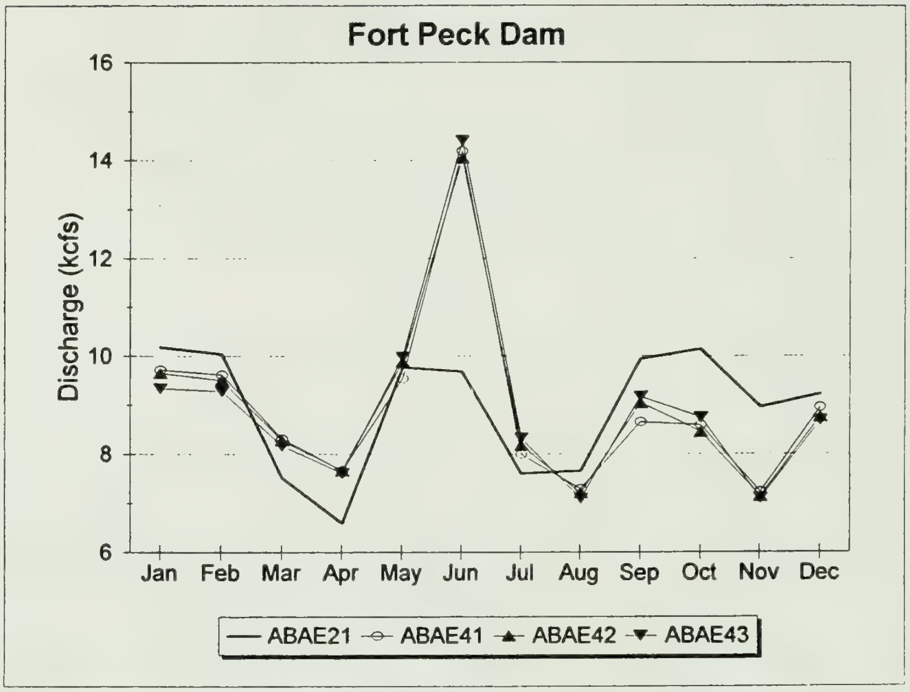

Figure 3-79. Average water releases for each month of the year from Fort Peck Dam over the 96-year simulation period for four alternatives with different spring service levels.

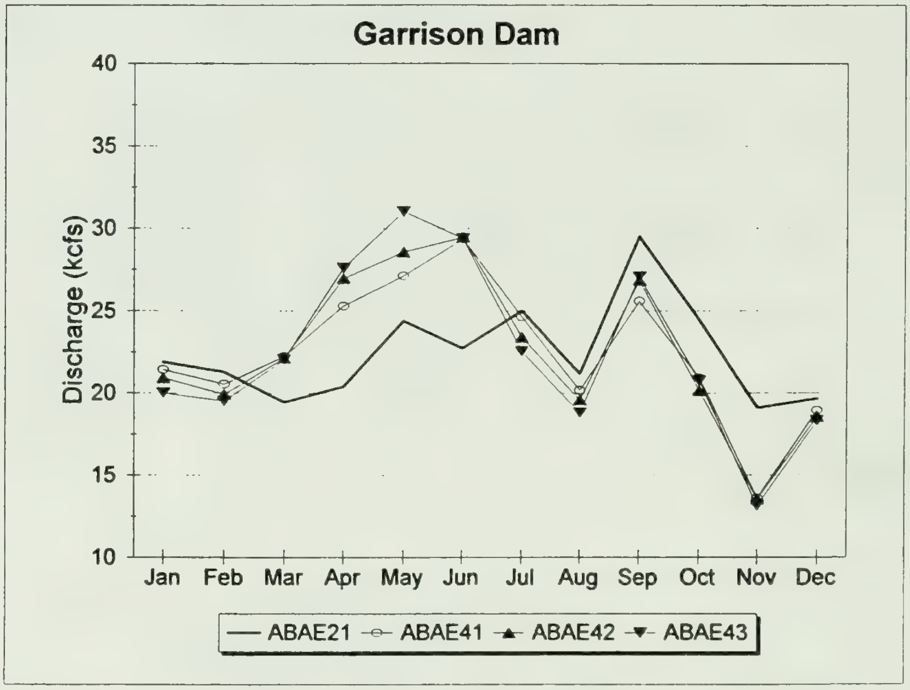

Figure 3-80. Average water releases for each month of the year from Garrison Dam over the 96-year simulation period for four alternatives with different spring service levels.

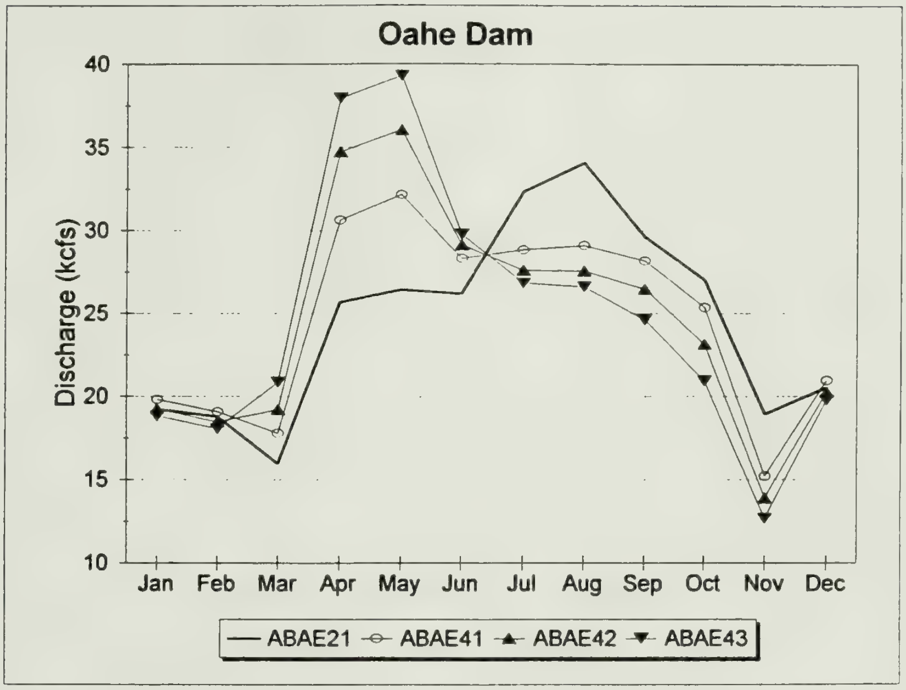

Figure 3-81. Average water releases for each month of the year from Oahe Dam over the 96-year simulation period for four alternatives with different spring service levels.

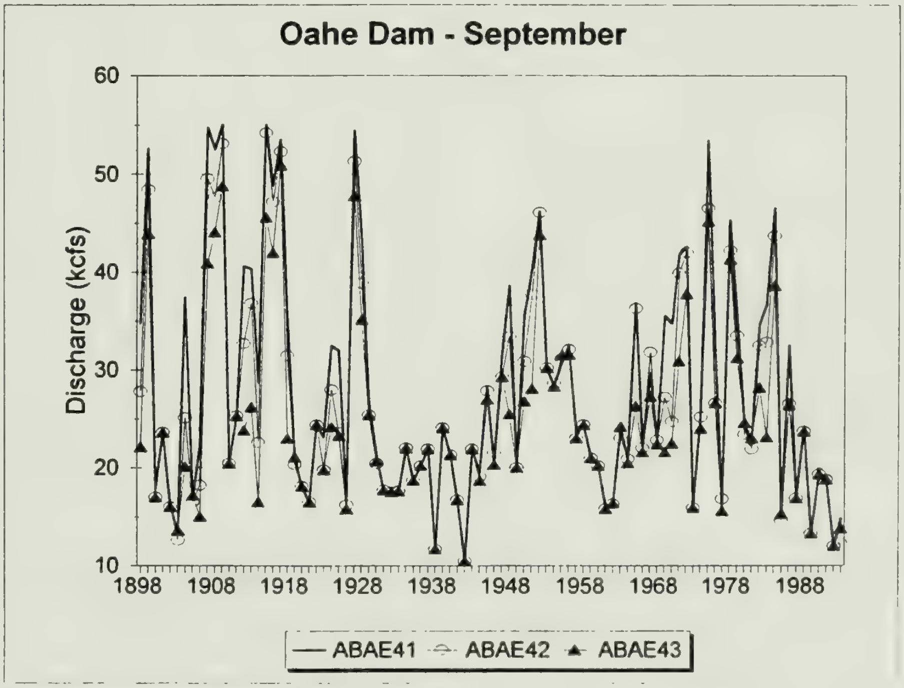

Figure 3-82. Average September water releases from Oahe Dam for three A-pool Native Fish alternatives with different spring service levels over the 96-year simulation period.

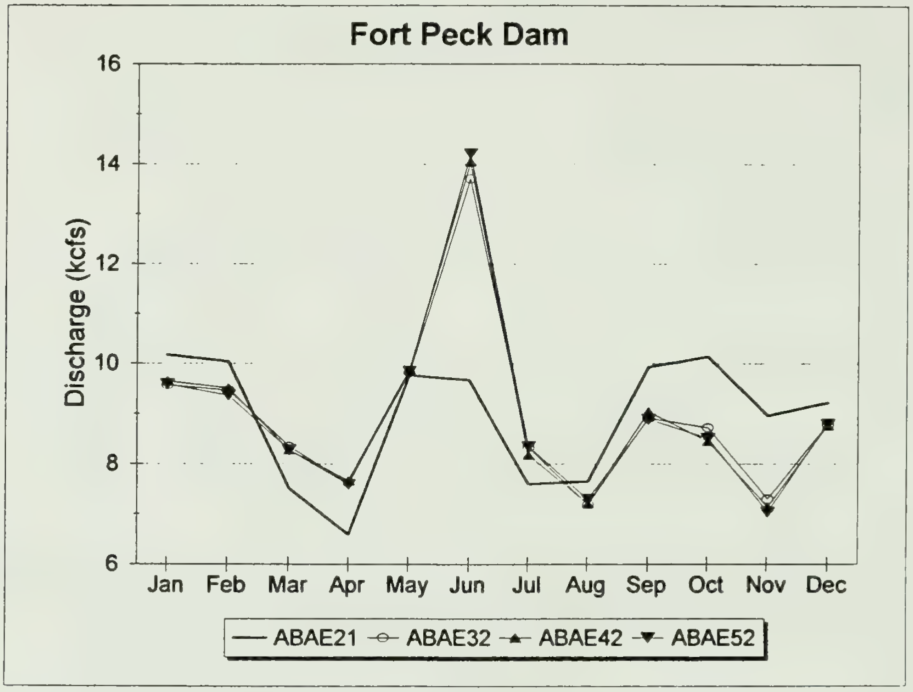

Figure 3-83. Average water releases for each month of the year from Fort Peck Dam over the 96-year simulation period for four alternatives with differing flood control constraints.

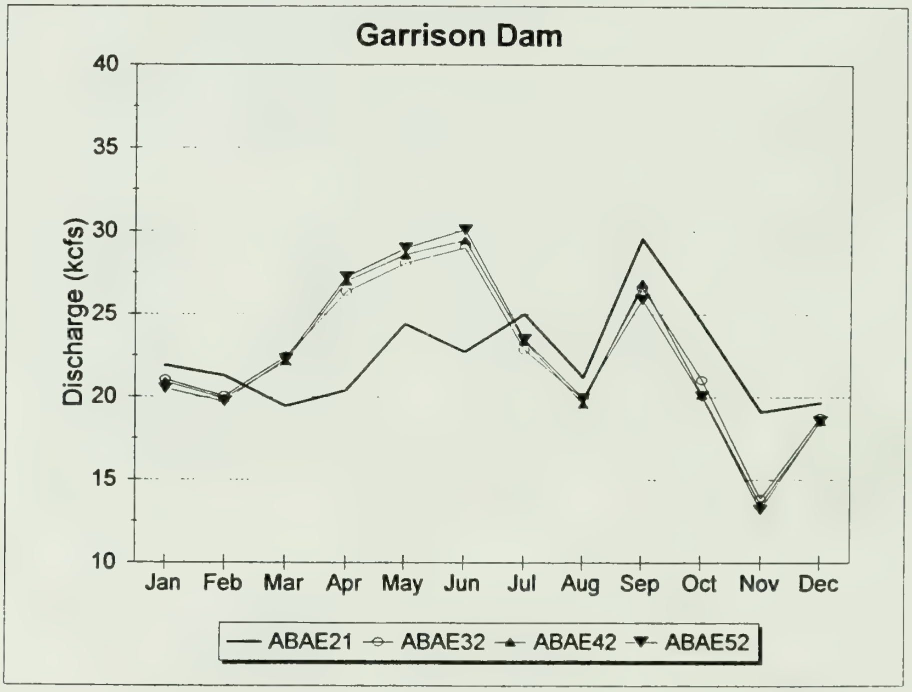

Figure 3-84. Average water releases for each month of the year from Garrison Dam over the 96-year simulation period for four alternatives with differing flood control constraints.

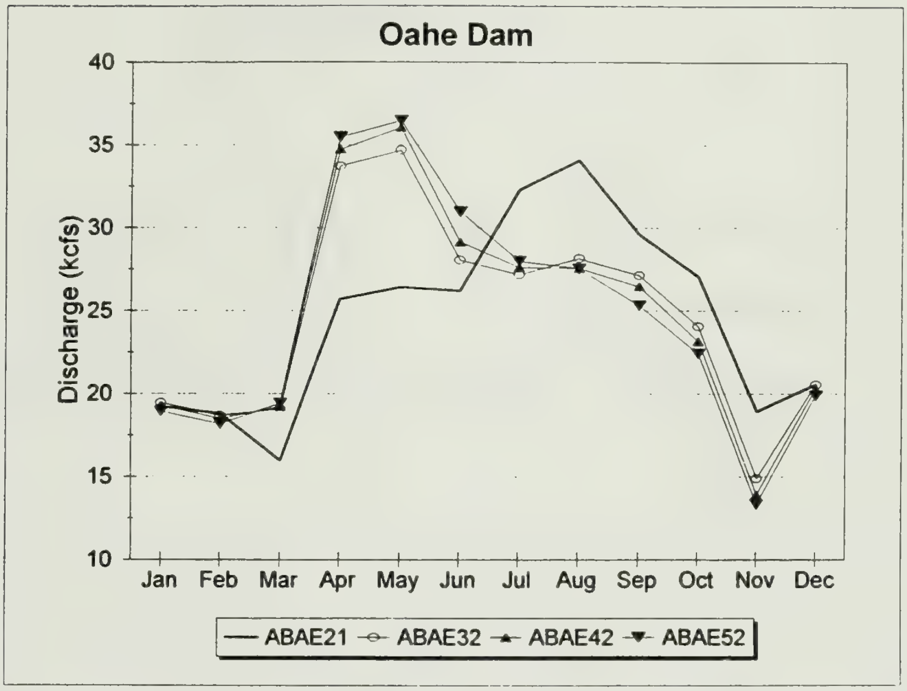

Figure 3-85. Average water releases for each month of the year from Oahe Dam over the 96-year simulation period for four alternatives with differing flood control constraints.

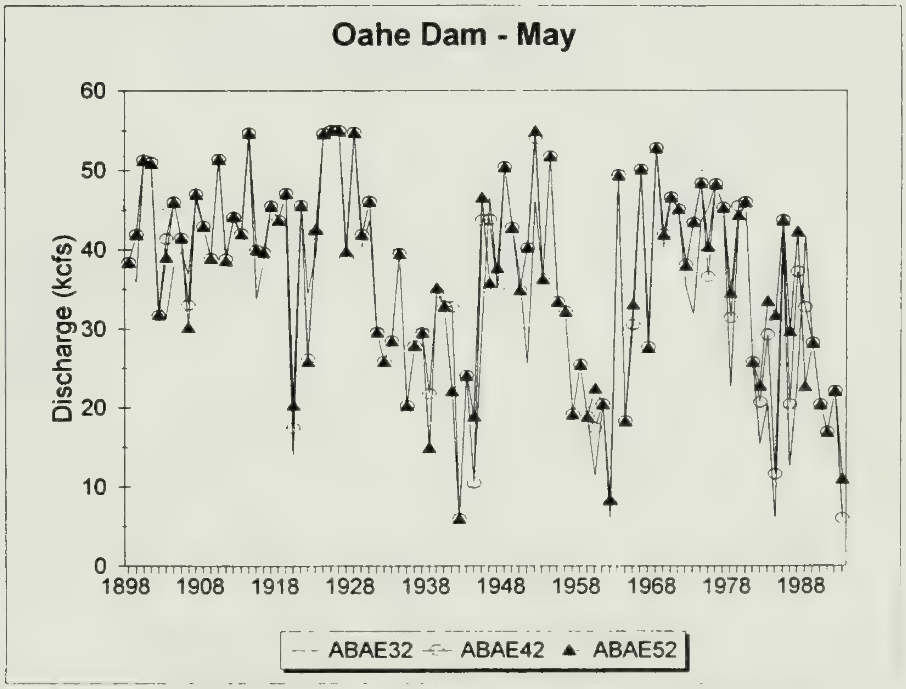

Figure 3-86. Average May water releases from Oahe Dam for three A-pool Native Fish alternatives with differing flood control constraints over the 96-year simulation period.

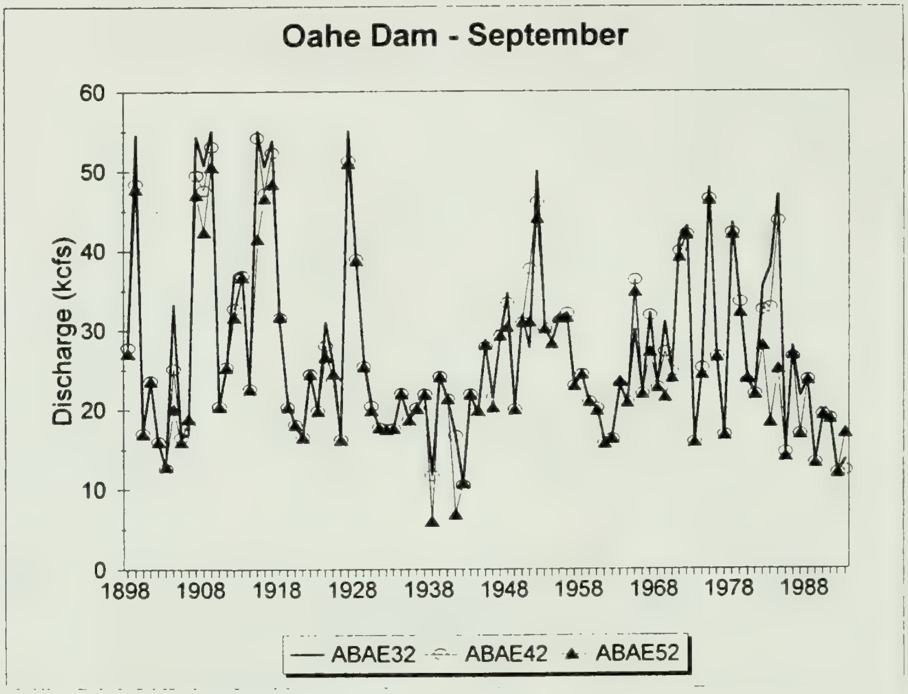

Figure 3-87. Average September water releases from Oahe Dam for three A-pool Native Fish alternatives with differing flood control constraints over the 96-year simulation period.

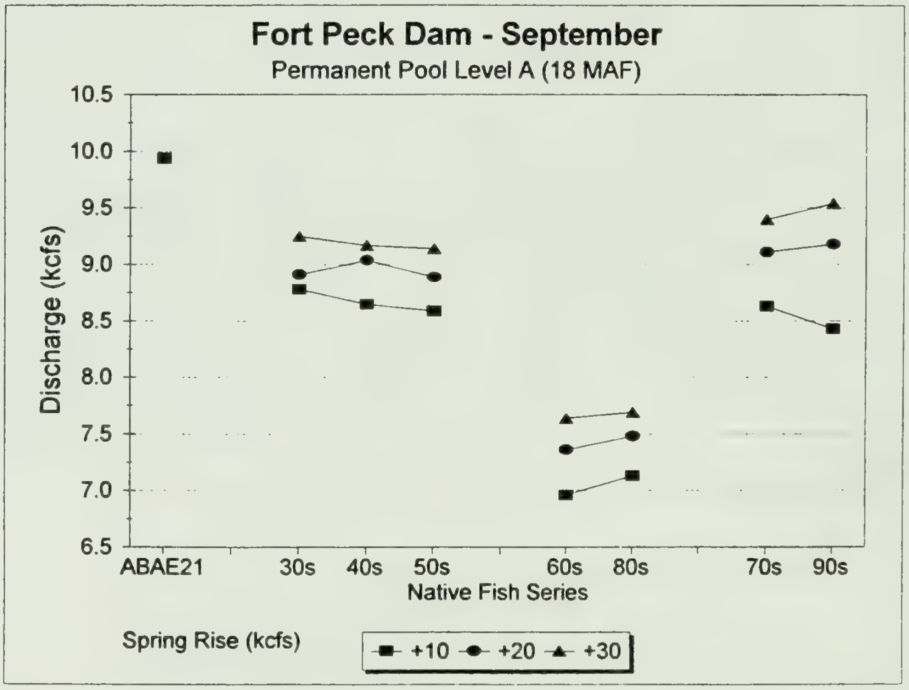

Figure 3-88. Average September water releases from Fort Peck Dam for A-pool Native Fish alternatives over the 96-year simulation period.

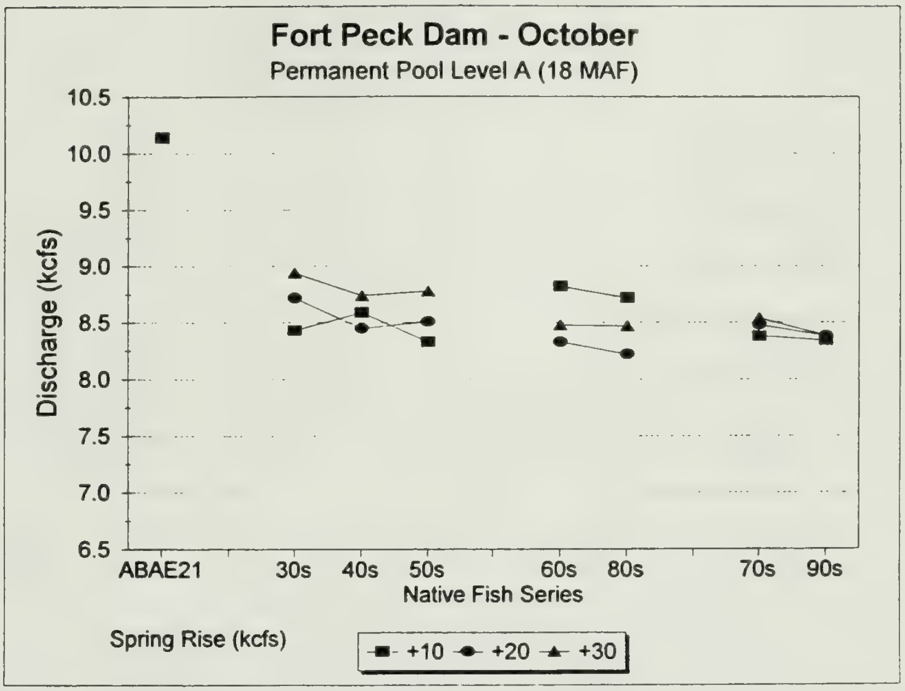

Figure 3-89. Average October water releases from Fort Peck Dam for A-pool Native Fish alternatives over the 96-year simulation period.

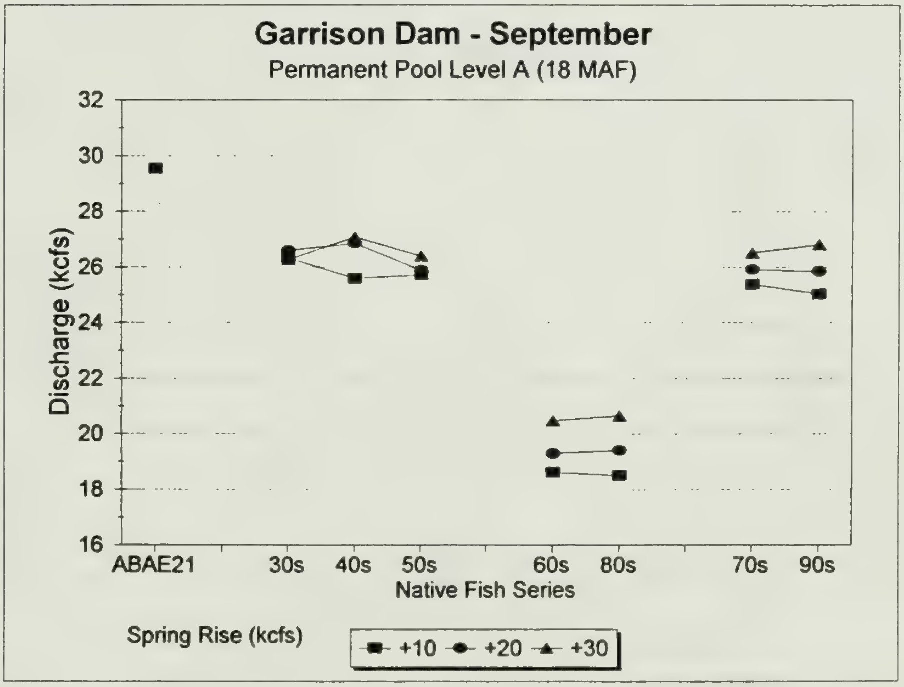

Figure 3-90. Average September water releases from Garrison Dam for A-pool Native Fish alternatives over the 96-year simulation period.

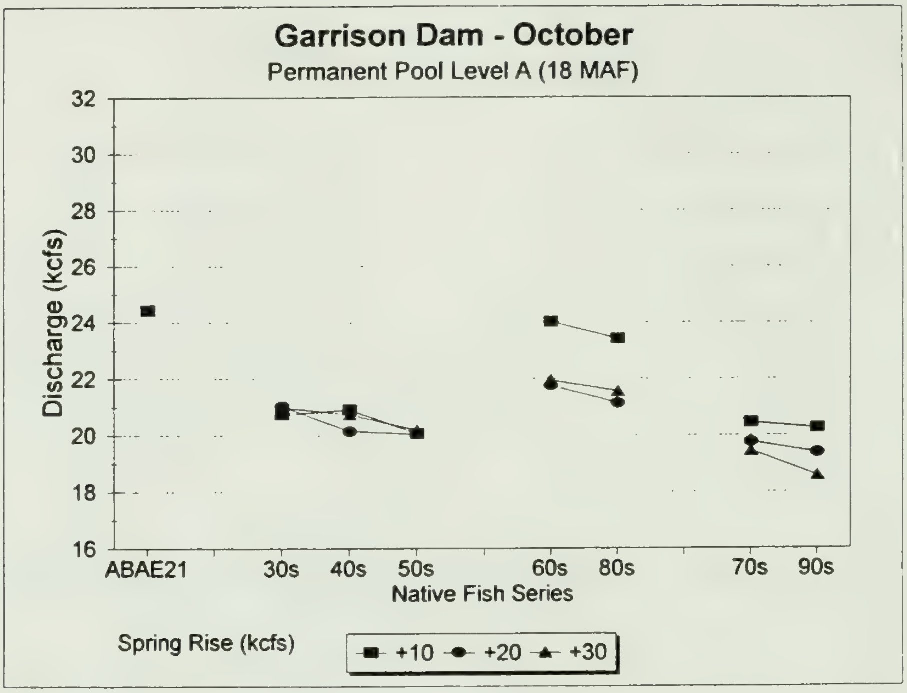

Figure 3-91. Average October water releases from Garrison Dam for A-pool Native Fish alternatives over the 96-year simulation period.

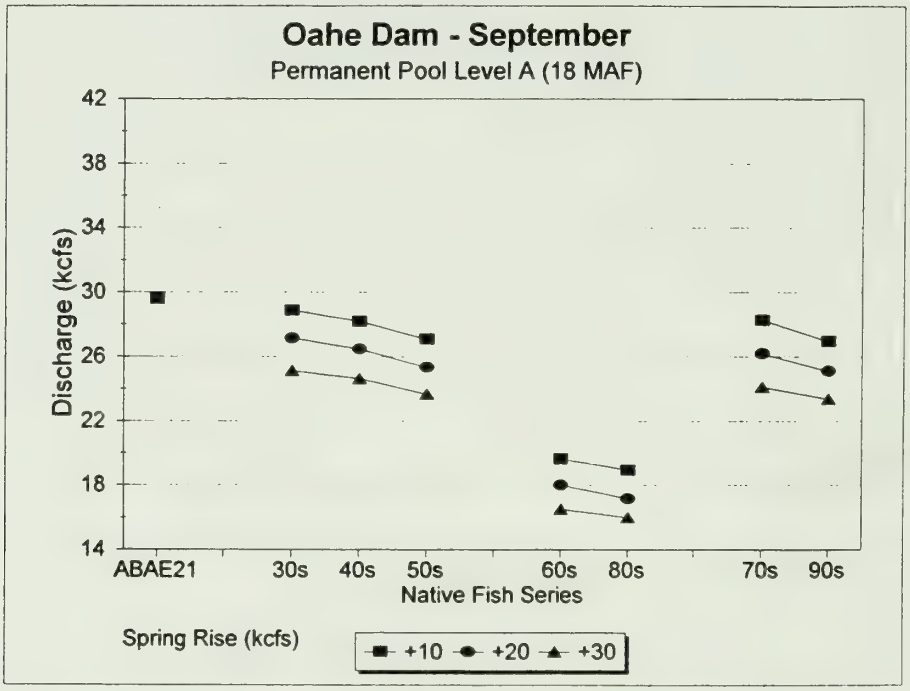

Figure 3-92. Average September water releases from Oahe Dam for A-pool Native Fish alternatives over the 96-year simulation period.

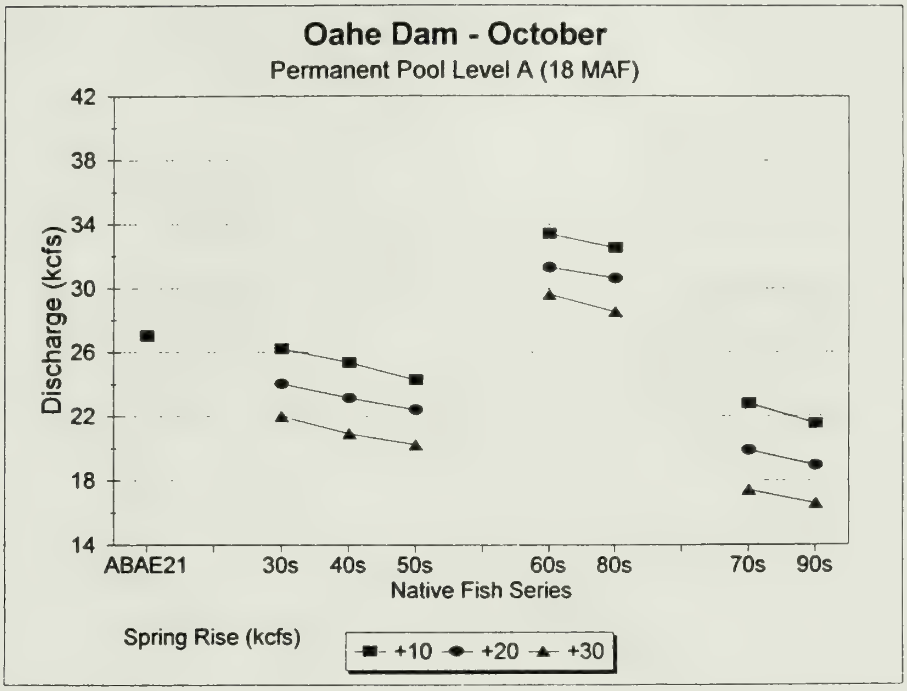

Figure 3-93. Average October water releases from Oahe Dam for A-pool Native Fish alternatives over the 96-year simulation period.

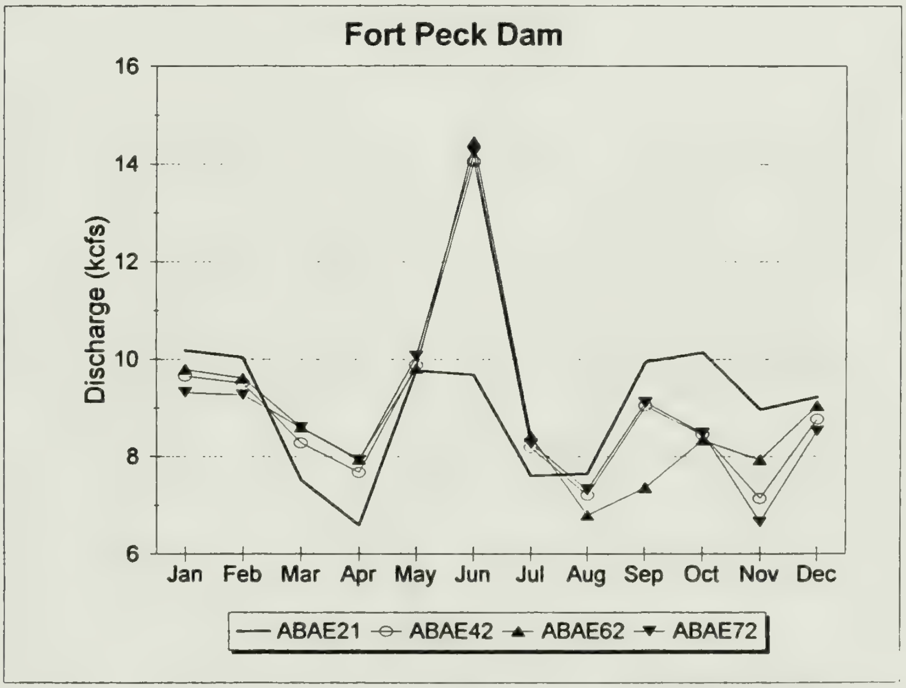

Figure 3-94. Average water releases for each month of the year from Fort Peck Dam over the 96-year simulation period for four alternatives with differing navigation season lengths.

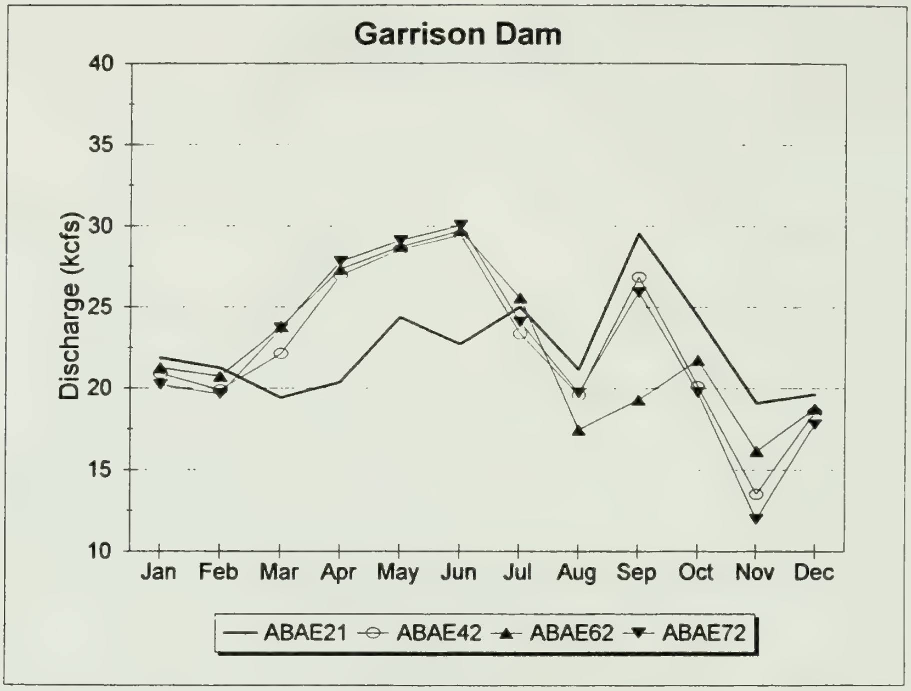

Figure 3-95. Average water releases for each month of the year from Garrison Dam over the 96-year simulation period for four alternatives with differing navigation season lengths.

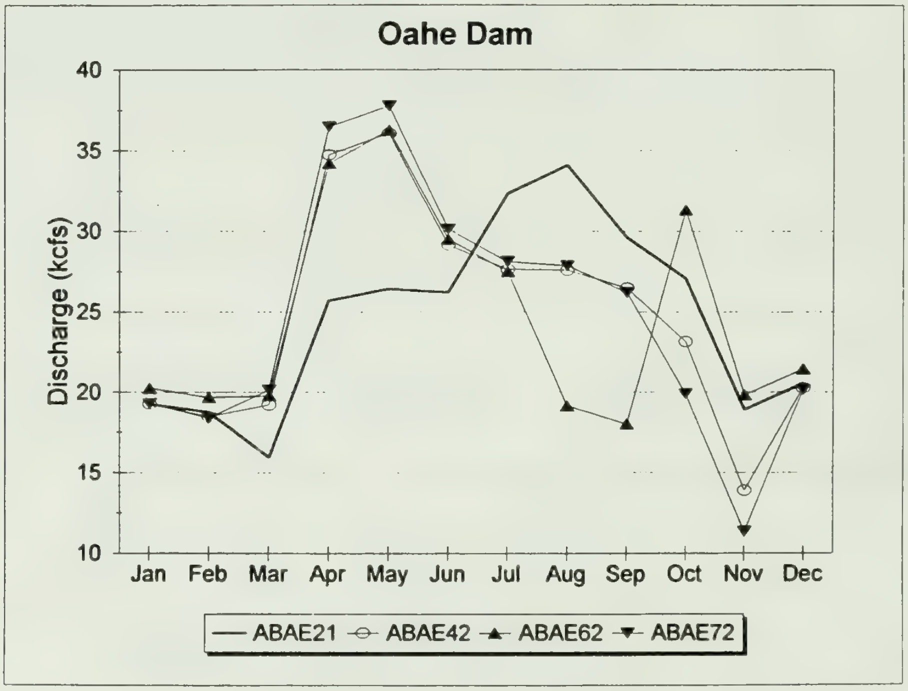

Figure 3-96. Average water releases for each month of the year from Oahe Dam over the 96-year simulation period for four alternatives with differing navigation season lengths.

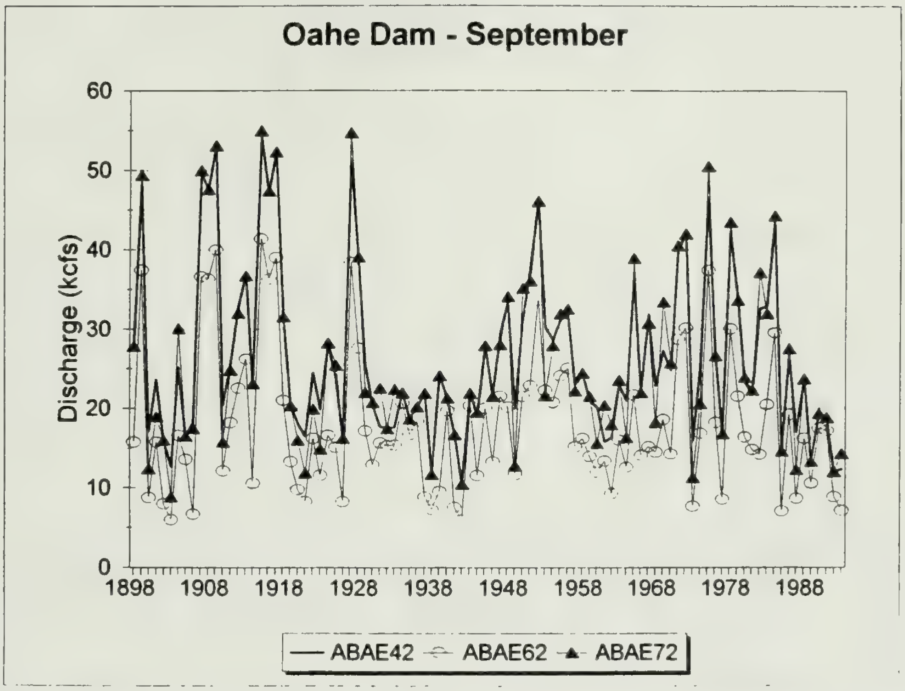

Figure 3-97. Average September water releases from Oahe Dam for three A-pool Native Fish alternatives with differing navigation seasons over the 96-year simulation period.

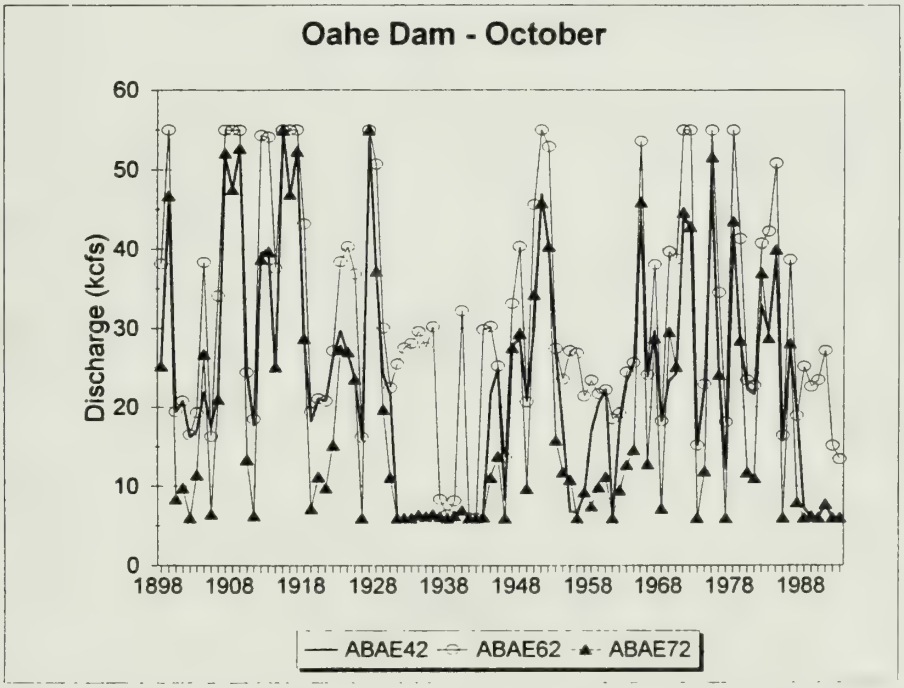

Figure 3-98. Average October water releases from Oahe Dam for three A-pool Native Fish alternatives with differing navigation seasons over the 96-year simulation period.

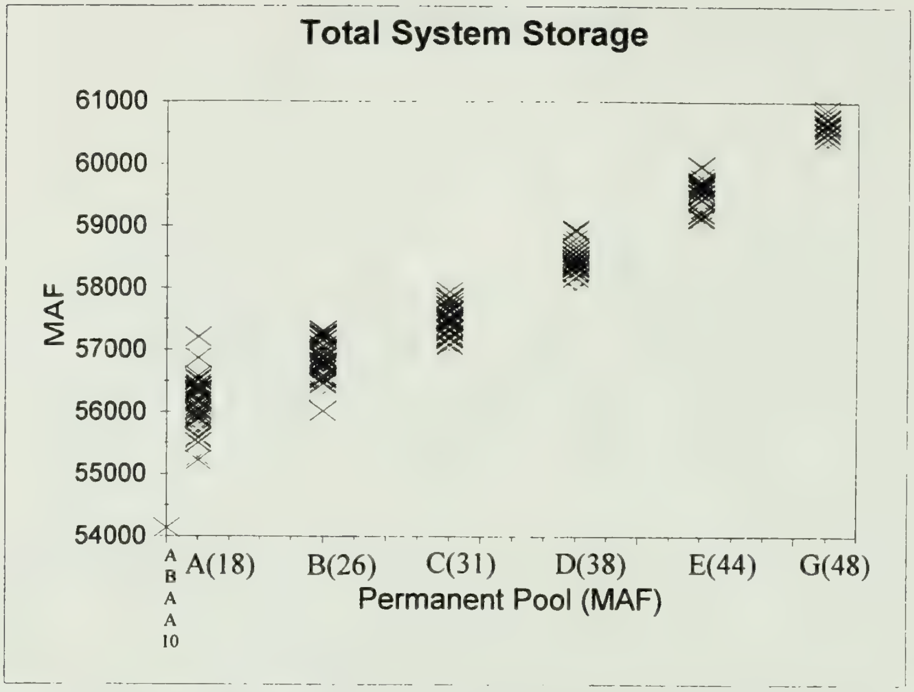

Figure 3-99. Average annual total system storage in the six mainstem lakes for the Basic Set of alternatives for the 96-year simulation period.

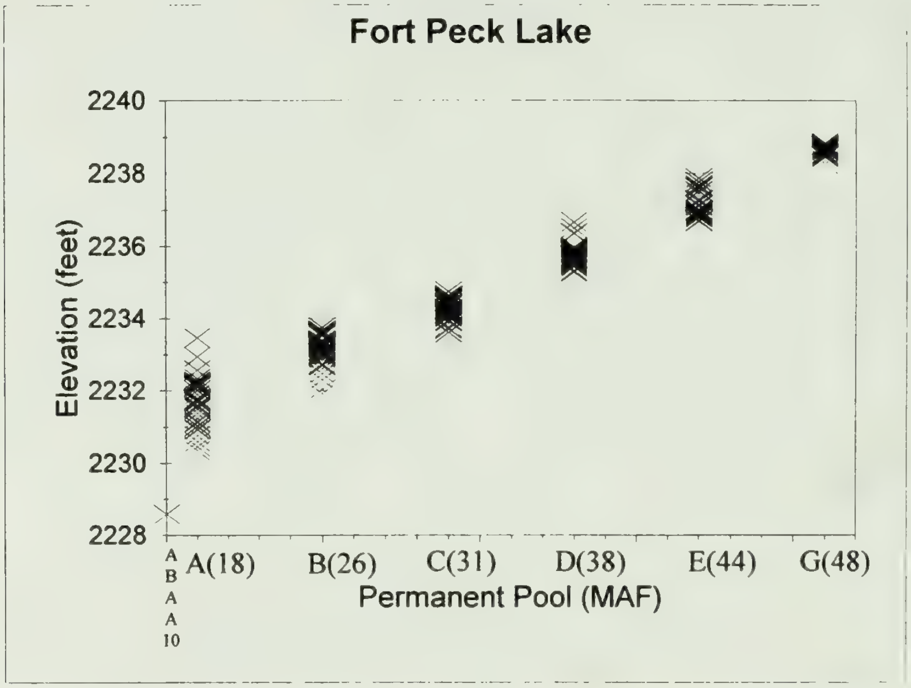

Figure 3-100. Average annual water surface elevation in Fort Peck Lake for the Basic Set of alternatives for the 96-year simulation period.

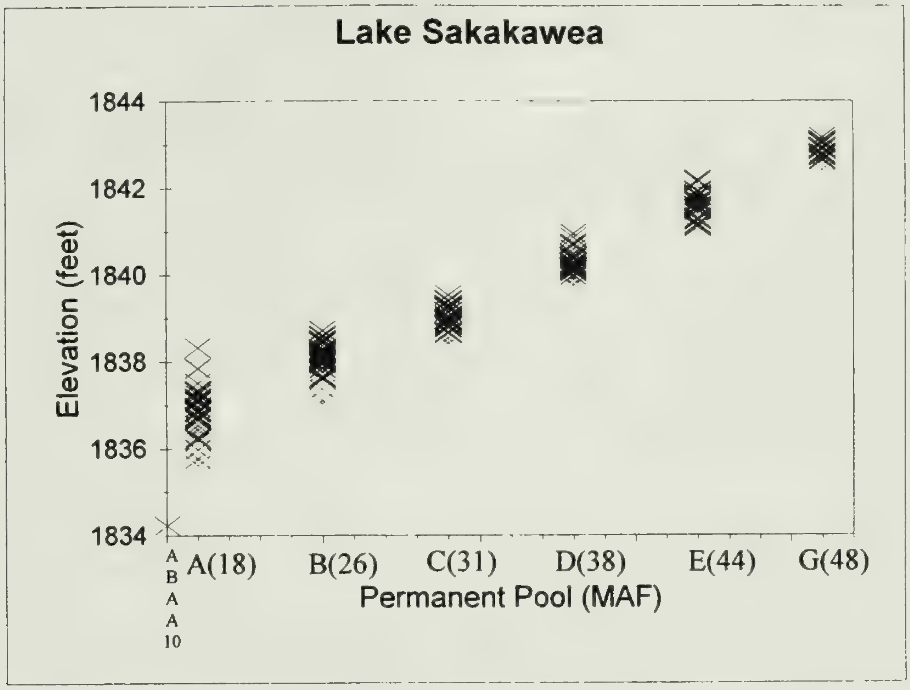

Figure 3-101. Average annual water surface elevation in Lake Sakakawea for the Basic Set of alternatives for the 96-year simulation period.

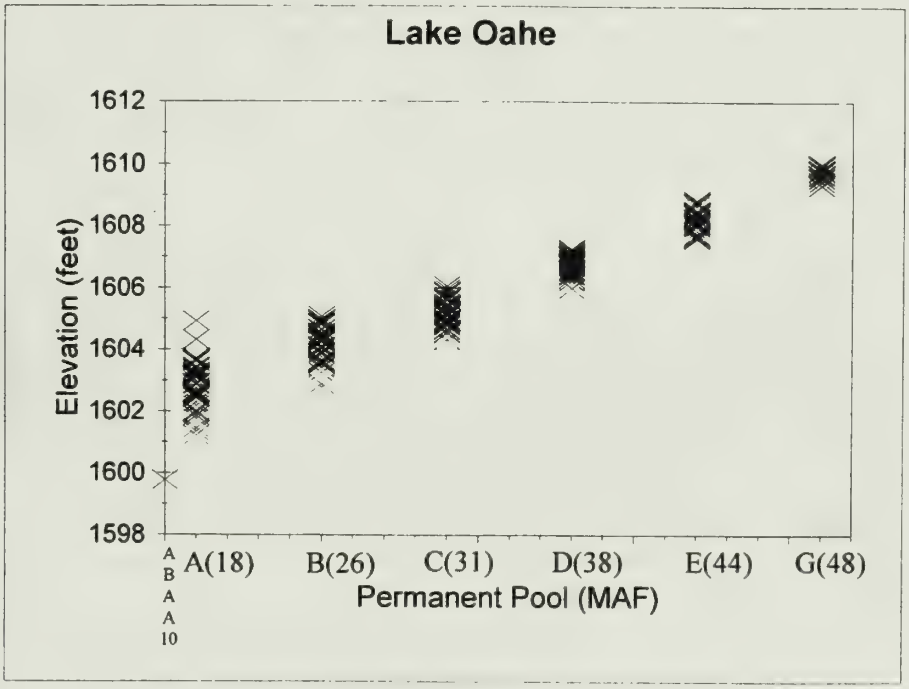

Figure 3-102. Average annual water surface elevation in Lake Oahe for the Basic Set of alternatives for the 96-year simulation period.

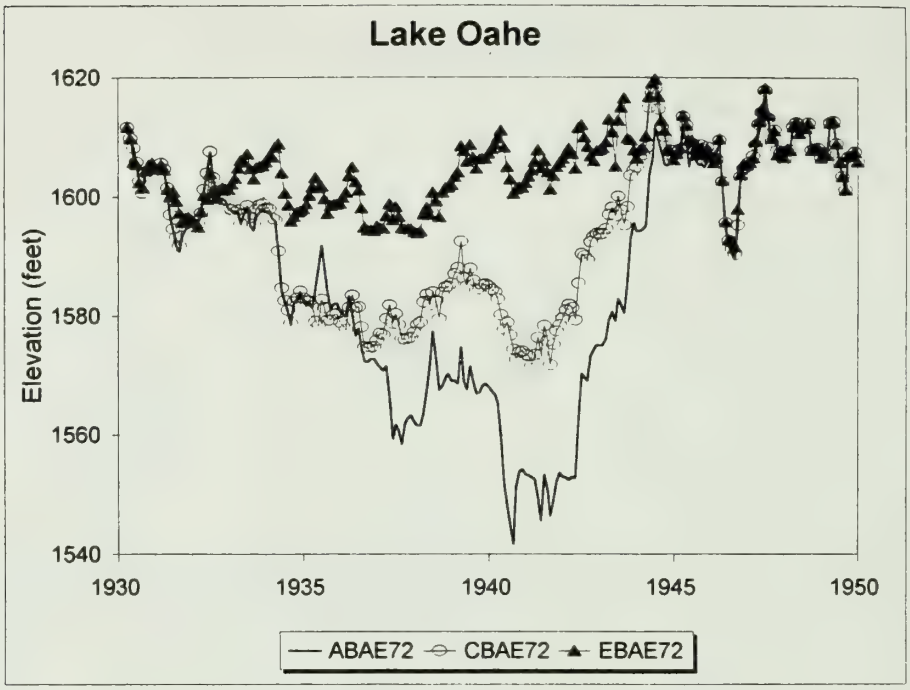

Figure 3-103. Average monthly water surface elevation in Lake Oahe over the simulation period 1930 to 1950 for alternatives ABAE72, CBAE72, and EBAE72.

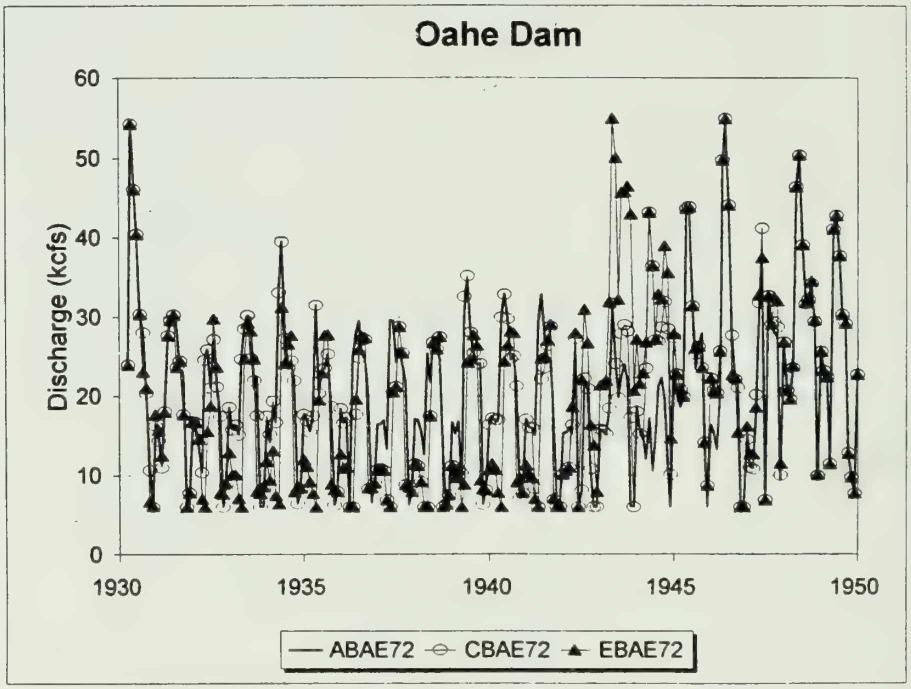

Figure 3-104. Average monthly water releases from Oahe Dam over the simulation period 1930 to 1950 for alternatives ABAE72, CBAE72, and EBAE72.

4.0 WETLAND/RIPARIAN HABITAT

Wetland and riparian habitat is influenced by reservoir and river hydrology. The natural plant communities comprising the Missouri River floodplain have adapted to particular combinations of inundation depths, durations, and frequency. Water level and shore topography strongly influence inundation depth, and they in turn are determined by reservoir releases, precipitation, tributary inputs, erosion, and sediment deposition. Wetland communities change as hydrology and channel morphology changes, or as a result of plant community aging and natural succession. River management will markedly influence wetland extent and composition, but other factors not related to river management such as natural succession, land clearing, and drainage alteration, will continue to affect wetland and riparian resources as well.

Effects of alternative Missouri River Master Water Control Plans on wetland and riparian resources were evaluated with results from a model that simulates wetland and riparian acreage over 96 years of simulated hydrology (Corps, 1994h). The model calculates annual acreage as a function of three factors: site topography, simulated water levels, and vegetation type responses to monthly (growing season) changes in water table for each of 13 cover types. It also simulates changes among vegetation types resulting from natural succession. The key hydrological factors driving the model are frequency, depth, and duration of inundation and saturation, derived from elevational relationships to river or reservoir water level. The model does not account for changes in river morphology that may result from scouring, which can occur at high flows. Although some scouring still occurs at some locations in the Missouri River, much of the channel has become armored or has reached equilibrium with the slope of the river. For this reason, additional scouring is expected to be minimal.

Annual acreage of seven wetland vegetation types are combined into one value for wetland habitat, and converted into 96-year means to simplify comparison of 383 alternatives. Simulated mean annual wetland acreage for each alternative is presented in Table 4-1. Annual acreage of riparian forest and riparian shrub vegetation are similarly combined, and converted to 96-year means. Simulated mean annual acreage of woody riparian vegetation is presented for each alternative in Table 4-2.

4.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

4.1.1 Wetlands

The modified navigation criteria would hold back more water in the reservoirs during drier years, compared to the current criteria (Section 3.1). Modified intrasystem regulation would markedly alter storage and release patterns of the three upper reservoirs creating a 3-year cycle of drawdown and refill. The two changes in water control would alter flows and elevations, with effects on wetland resources.

Neither of the two factors greatly affect total system wetland acreage. During droughts, the modified navigation criteria would return reservoir levels more promptly and promote earlier recovery of wetlands (Figure 4-1). The earlier recovery slightly increases the 96-year mean annual acreage (Table 4-3).

The increased acreage attributable to effects of the modified navigation criteria during drought recovery occurs in the upper river (Figure 4-2), lake deltas (Figure 4-3), and lower river (Figure 4-4). The modified navigation criteria, however, tend to support less acreage in the upper river prior to drought recovery, which reduces the 96-year mean acreage for the upper river system.

Modified intrasystem regulation tends to support greater wetland acreage in the upper river prior to the onset of drought (Figure 4.2), and to adversely affect wetland acreage in the deltas during non-drought years (Figure 4-3). Thus, modified intrasystem regulation constitutes a trade-off between increased acreage in the upper and lower river and reduced acreage in the lake deltas.

Effects of the modified navigation and intrasystem regulation criteria on mean annual wetland acreage simulated for individual reaches are relatively small (Table 4-3), partly due to the effect of averaging over 96 years. Reaches exhibiting the greatest differences in mean acreage include Fort Peck reach, Garrison reach, Lake Oahe mainstem and tributary deltas, Fort Randall reach, and Sioux City (Ponca) reach. At four of the eleven reaches, effect of the modified navigation criteria on mean wetland acreage reverses sign depending on which pair of alternatives serves as the basis for comparison. This suggests that the modified intrasystem regulation interacts with the modified navigation criteria to jointly influence monthly hydrology and wetland acreage. Thus, the effect of the modified navigation criteria depends partly on whether it is coupled with intrasystem regulation.

The modified navigation and intrasystem regulation criteria affect wetland acreage at all reaches from Fort Peck Lake to St. Joseph (Figures 4-5 through 4-14), but have little effect below the St. Joseph reach (Figure 4-15). The modified navigation criteria have the greatest effect on mean annual wetland acreage in the Fort Peck reach (930-acre increase when combined with modified intrasystem regulation), Garrison reach (890-acre decrease when combined with modified intrasystem regulation), Lake Oahe tributary deltas (810-acre increase when combined with modified intrasystem regulation), and Fort Randall reach (760-acre increase when not combined with modified intrasystem regulation). The modified navigation criteria tend to increase acreage except at Gavins Point reach (Figure 4-12), where wetland acreage simulated under the current navigation rule curves increases sharply in 1937 under current criteria. The sharp increase in wetland acreage at Gavins Point reach results from sharp reductions in 1937 flows under current navigation criteria. The 1937 flow reductions are a consequence of cessation of navigation service. Reduced flows expose shore sediments to a sequence of monthly river stages suitable for establishment of emergent marsh, which persists in subsequent years of higher stages.

Modified intrasystem regulation generally increases mean annual acreage in the Fort Peck reach and Sioux City reach, but decreases acreage in Fort Peck delta and Lake Oahe delta (mainstem). Both the direction (increase or decrease) and magnitude of effect vary sufficiently in all the reaches to preclude identifying simple relationships between hydrology and wetland acreage. Modified intrasystem regulation would periodically produce greater mean monthly flows at the Fort Peck reach compared to the current regulation, as exemplified in Figure 4-16. The higher mean monthly flows generated by the ABAA11 alternative compared to ABAA10 tend to precede intervals of greater wetland acreage (Figure 4-6), and would tend to convert riparian vegetation to wetland (compare Table 4-3, Fort Peck reach with corresponding acreage in Table 4-4).

At Lake Oahe delta, reduced wetland acreage associated with modified intrasystem regulation occurs immediately in the first few years of simulation, with little subsequent relative change between ABAA11/ABAA21 and ABAA10/ABAA20 (Figure 4-9). The improvement of the ABAA20/ABAA10 alternatives appears to result from lake elevations during 1899 through 1901 being 2 to 5 feet higher than those produced by ABAA11/ABAA21 (Figure 4-17). Therefore, increased wetland acreage at Lake Oahe delta associated with ABAA10 and ABAA20 might be partly attributable to the particular year selected for initiating the simulation run (1898).

4.1.2 Riparian Vegetation

The modified navigation criteria and proposed intrasystem regulation reduce mean annual simulated acreage of woody riparian vegetation in the river system by 2,000 to 4,000 acres (Table 4-4). These changes would convert greater acreage of riparian vegetation to wetland. In general, operations which favor wetland will reduce riparian acreage. Because woody riparian vegetation encompasses considerable area but includes only two vegetation types (riparian forest and shrub), the changes in riparian acreage occur relatively abruptly (Figure 4-18). Although conversion would occur throughout the Missouri River system, little acreage would be converted below St. Joseph. Greatest reductions would occur in the Fort Peck reach, Lake Oahe delta, Sioux City reach, and Omaha reach. Maximum acreage of woody riparian vegetation develops during and following droughts, regardless of navigation or intrasystem regulation criteria (Figures 4-19 through 4-22).

4.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVEL

4.2.1 Wetlands

Minimum nonnavigation service level does not greatly affect simulated mean annual wetland acreage in the entire Missouri River system (Figure 4-23). Winter minimum service level has no consistent effect. Increasing spring/fall minimum service levels from 9 to 18 kcfs decreases the mean of the 96-year mean annual wetland acreage simulated for E pool alternatives by about 1 to 2 percent, but does not consistently affect the means for other alternatives. Increasing summer minimum service from 9 to 15 or 18 kcfs increases the mean of the 96-year mean annual acreage simulated for the G permanent pool series by about 2,500 acres, representing a change of 1 to 2 percent. These increases concentrate in the upper river, as described further below. Summer minimum service levels affect other permanent pool series similarly but to a lesser extent.

Trends of minimum nonnavigation service level effects on simulated wetland acreage occur in each of the three sub-systems (Figures 4-24 through 4-26). Among G permanent pool alternatives, increasing winter minimum nonnavigation service from 9 to 18 kcfs tends to decrease the mean of 96-year mean annual wetland acreage in the upper (riverine) river, but tends to increase acreage in one or more of the deltas. Winter season service does not appear to significantly affect wetland acreage among other permanent pool series. Increasing spring/fall minimum nonnavigation service tends to slightly decrease wetland acreage in the delta system and lower river system (Figures 4-25 and 4-26). Increasing nonnavigation summer minimum service from 9 to 18 kcfs increases the mean of the 96-year mean annual wetland acreage in the upper river (riverine) system by as much as approximately 3,000 acres, or 6 percent (Figure 4-24). In the deltas, however, increasing summer service tends to slightly decrease wetland acreage (Figure 4-25).

General trends within individual reaches can be detected in Figures 4-27 through 4-37 and in Table 4-5. In many cases, increasing minimum nonnavigation service levels (various seasons) produces no consistent pattern of change in the means of 96-year mean annual wetland acreage. Where detectable patterns occur, sign of effect (increasing or decreasing acreage) varies among reaches.

4.2.1.1 Winter Minimum Nonnavigation Service Level. Winter minimum nonnavigation service levels affect the mean of 96-year mean annual wetland acreage differently among reaches as well as among permanent pool levels (Table 4-5). At Garrison reach, for example, increasing winter minimum service tends to decrease the mean of the 96-year mean annual wetland acreage when associated with A or D permanent pools, but increase the mean when associated with E permanent pools.

Winter minimum nonnavigation service most consistently affects wetland acreage at five reaches. Increasing winter season minimum service tends to associate with decreasing wetland acreage at Fort Peck reach, Lake Oahe delta, Sioux City (Ponca) reach, and (very slightly) St. Joseph reach. It tends to associate with increasing acreage at Lake Sakakawea delta. Differences among the means of mean annual wetland acreage vary from a few hundred acres (St. Joseph reach) to over 1,000 (Fort Peck reach, and also at Fort Randall reach but only for alternatives with G permanent pool levels).

Increasing winter season minimum nonnavigation service levels tends to drop summer water levels relatively lower at Lake Sakakawea during droughts, but raise them more quickly in the period of drought recovery. The annual differences between lake elevations resulting from alternative ADBE21 (18 kcfs winter minimum nonnavigation service) and alternative ABBE21 (12 kcfs winter minimum service) are compared in Table 4-6 for the years 1919 through 1924. The 400 more acres of wetland produced by alternative ADBE21 in 1921 result from one to several years of lake elevations 0.1 to 0.4 feet lower than those produced by the ABBE21 alternative. In this example, differences in simulated wetland acreage (Figure 4-38) result from relatively slight differences in lake level.

At the Lake Oahe delta, increasing winter minimum service from 9 (alternative AAAE21) to 15 kcfs (alternative ACAE21) also results in lower lake levels in summer months during droughts (Figure 4-39). Unlike the example cited for Lake Sakakawea, in this case lower water levels trigger reduced wetland acreage (Figure 4-40). The difference between alternative ACAE21 and AAAE21 ranges up to about 7,000 acres in specific years.

4.2.1.2 Spring/Fall Minimum Nonnavigation Service Level. Increasing spring/fall minimum nonnavigation service levels tends to decrease acreage in Lake Oahe delta (A, D and E pool series), Sioux City reach (D and E pool series) and St. Joseph reach (A and C pool series) (Table 4-5). Largest effects on the mean of mean annual wetland acreage occur at Lake Oahe delta (about 1,000 acres difference between highest and lowest mean). For example, alternative AAAE21 (spring/fall minimum nonnavigation service of 9 kcfs) creates about 600 acres more wetland per year on average at the Lake Oahe delta compared to the AADE21 alternative (spring/fall minimum nonnavigation service of 18 kcfs). The greater acreage at the Lake Oahe delta probably results from higher lake elevations in summer months, coupled with advantageous monthly (May to August) elevation fluctuations.

4.2.1.3 Summer Minimum Nonnavigation Service Level. Effects of summer minimum nonnavigation service levels on wetlands appear similar to those described for spring/fall minimum service levels. During the 96-year simulation period, higher summer minimum nonnavigation service levels can increase or decrease flows in the Fort Randall reach, as shown in Figure 4-41 (using alternatives ABBD21 and ABBB21 as examples). The 6-kcfs greater flow produced by the ABBD21 alternative in all summer months in 1941, increases simulated wetland area in the Fort Randall reach in 1941 by about 2,000 acres (Figure 4-42). Although in some subsequent years the ABBD21 alternative produces lower monthly flows compared to ABBB21, the magnitude of difference among flows is much smaller than in 1941, and the relative difference of about 2,000 acres of wetlands persists for the remainder of the simulation period.

4.2.2 Riparian Vegetation

Minimum nonnavigation service levels affect riparian vegetation only slightly. Over the entire river system, increasing minimum service levels in the winter and spring/fall seasons tends to slightly increase the means of the 93-year mean annual acreage of woody riparian vegetation (Figure 4-43). The effect is more pronounced in the upper river system including the deltas (Figures 4-44 through 4-46).

The means of 96-year mean annual acreage of woody riparian vegetation are graphed against permanent pool level and minimum nonnavigation service level in Figures 4-47 through 4-57. Detectable relationships between minimum service level and acreage are summarized in Table 4-7. In many reaches, minimum nonnavigation service produces little or no apparent effect on riparian acreage. Where effects are discernable, mean acreage differences among service levels are small. At the three reaches where effects are greatest, Fort Peck reach (permanent pool levels of 44 and 48 MAF), Lake Oahe delta, and Lake Oahe tributary deltas, the maximum means of mean acreage of riparian vegetation exceed corresponding minimum means by 10 to 15 percent.

In general, increasing minimum nonnavigation service (all seasons) tends to convert wetland vegetation to riparian types, thus increasing riparian vegetation acreage. The trend depicted for Lake Oahe delta riparian acreage in Figure 4-51, for example, is approximately the inverse of the wetland acreage trend depicted in Figure 4-31. Higher (winter and spring/fall) service levels tend to lower reservoir water levels and decrease flooding/saturation frequencies in wetlands located at the higher end of the lake shoreline. In the Fort Randall and Gavins Point reaches, increasing minimum nonnavigation service (winter and spring/fall) tends to increase woody riparian vegetation as well as wetland acreage. In these reaches, increased riparian acreage probably derives from conversion of wetland to riparian, but the increased flows from higher minimum nonnavigation service levels also create additional wetland acreage.

4.3 NATIVE FISH SERIES

4.3.1 Wetlands

Mean (96-year) annual wetland acreage of Native Fish alternatives are sorted by permanent pool level, spring rise, navigation season length, and flood control constraints in Figures 4-58 through 4-132.

4.3.1.1 Effect of Higher Spring Service Levels. Increasing spring service levels increases mean annual wetland acreage of the Missouri River system by 5 to 10 percent depending on permanent pool level, navigation season, and flood control constraints (Figures 4-58 through 4-62). Greatest increases occur in deltas and the lower river (Figures 4-68 through 4-77). Effects of higher spring service levels on the upper river (riverine) are mixed (Figures 4-63 through 4-67), largely because of the effects at the Fort Peck reach, where increased spring releases tend to decrease wetland acreage.

Effects of raising spring service levels on mean annual wetland acreage at individual reaches are summarized in the following table:

Spring Service Level (kcfs) with Highest Wetland Acreage					
	Permanent Pool				
	A	B	C	D	E
Fort Peck Delta	65	65	65	65	65
Fort Peck Reach	45	45	45	45	45
Lake Sakakawea Delta	65	65	65	65	MIXED
Garrison Reach	35	35	35	35	65
Lake Oahe Delta	MIXED	MIXED	MIXED	45	45
Lake Oahe Trb. Delta	55	55	55	MIXED	MIXED
Fort Randall Reach	65	65	65	65	65
Gavins Reach	65	65	65	65	65
Sioux City Reach	65	65	65	65	65
Omaha Reach	65	65	65	65	65
St. Joseph Reach	65	65	65	65	65

A "35," "45," "55," or "65" indicates the service levels (kcfs) associated with at least five of the seven maximum mean acreage values for that reach and permanent pool level shown in Figures 4-78 through 4-133; "MIXED" indicates that no single spring service level associated with maximum wetland acreage in more than four of the seven maximum alternatives. In most reaches, including the deltas, greater spring season releases from Gavins Point Dam promote markedly greater mean annual wetland acreage. Fort Peck reach, Garrison reach, and Lake Oahe delta (and tributary deltas) constitute three exceptions. In most riverine reaches at most permanent pool levels, higher spring flows inundate or saturate greater area of shore at frequency and duration conducive to wetland maintenance. Comparison of graphed responses of wetland and riparian vegetation, indicates that conversion of riparian vegetation types to wetland accounts for much of the increased wetland acreage in riverine reaches resulting from increased spring flow. In the Fort Peck Lake and Lake Sakakawea deltas, higher spring service levels cause earlier and more rapid drawdown of lakes, converting more area of open water to shoreline marsh.

Lake Oahe delta differs from other deltas because drawdowns resulting from higher spring service levels are more extreme. The Lake Oahe delta also contains considerable acreage where wetlands can establish during extended drawdown, if monthly lake elevations maintain moist but not flooded conditions. Small differences among alternative water control plans can translate into relatively large differences in wetland acreage at this delta. Wetland acreage simulated for the ABAE41 alternative, for example, exceeds that simulated for ABAE42 and ABAE32 by more than 2,000 acres for almost all years of the simulation period (Figure 4-133). The difference appears initially in 1899, as a result of June elevations being about 5 feet lower than those produced by ABAE42 and ABAE32 (Figure 4-134). The 5-foot difference under the ABAE41 hydrologic conditions of 45-kcfs spring service and reduced flood control constraints permits conversion of extensive acreage of riparian grass vegetation to emergent marsh. The increased wetland acreage accrued by ABAE41 persists through the following 94 years of simulation. The combination of higher spring service levels and reduced or eliminated flood control constraints can markedly influence wetland acreage at Lake Oahe delta, depending greatly on timing and small differences in elevation.

4.3.1.2 Effect of Flood Control Criteria.

Reduced flood control constraints on the spring releases tend to increase simulated mean annual wetland acreage in the Missouri River system (Figures 4-58 through 4-62, Table 4-8). Effects are much more pronounced when reductions are associated with a spring service level of 65 kcfs. Elimination of constraints also tends to increase wetland acreage, when combined with a spring service level of 45 kcfs. In few instances does elimination increase wetland acreage above the value resulting from constraint reduction. At most permanent pool levels, alternatives including a 55 or 65 kcfs spring service level produce less simulated acreage when coupled with eliminated constraints than when coupled with reduced constraints. If navigation season is shortened, alternatives with eliminated flood control constraints tend to decrease wetland acreage at all of the higher spring service levels compared to alternatives with "reduced" constraints (Figures 4-58 through 4-62).

Increased mean annual wetland acreage resulting from reduced flood control constraints is attributable to effects at the deltas and lower river (Table 4-8). Generally, gains in riverine wetland acreage in the lower river system due to reduced constraints are offset by losses of riverine acreage in the upper river. When spring service levels extend to 55 or 65 kcfs, elimination of constraints reduces wetland acreage (compared to alternatives with reduced constraints) in the upper river reaches, but has little effect on acreage in the deltas or lower river reaches. Effects of eliminating constraints in combination with a shortened navigation season essentially parallel trends observed for the existing navigation season, although decreases in acreage in the upper river are more pronounced when the navigation season is shortened (Figures 4-63 through 4-67).

Effects of reduced or eliminated flood control constraints on mean annual wetland acreage at individual reaches are summarized in Table 4-9. At the Garrison reach, Lake Oahe tributary deltas, and Sioux City reach, effects of reduced flood control constraints vary with permanent pool level and spring service level. No effects of reduced constraints occur at Fort Peck reach (except with E permanent pool and a 65-kcfs spring service level) or St. Joseph reach. Reduced constraints increase simulated mean annual wetland acreage by 2 to 3 thousand acres at Lake Oahe delta when combined with a spring season navigation service level of 45 kcfs (Figures 4-98 through 4-102); but reduce acreage by comparable amounts at Fort Randall reach and by smaller amounts at Gavins Point reach (Figures 4-108 through 4-117). As noted above, wetland acreage at Lake Oahe delta is sensitive to small differences in monthly elevation and timing. Complete elimination of flood control constraints can reverse the effects of reduced constraints (for example, at Garrison reach when spring service level is 55 kcfs), increase the effects (for example, Gavins Point Dam reach when spring service is set at 55 kcfs), or have little or no additional effect (Table 4-9).

4.3.1.3 Effect of Shortened Navigation Season. Eliminating navigation support in October and November would not affect wetland vegetation in any of the reaches or lakes of the Missouri River System except Lake Sakakawea (Figures 4-78 through 4-132 and 4-14 through 4-155). During these months, plants are mostly dead or dormant.

Eliminating navigation support in August and September would affect wetlands in certain reaches but would negligibly affect riparian vegetation. Eliminating navigation support in these months, combined with reduced or eliminated flood control constraints, would probably change wetland acreage in the entire Missouri River system by less than 5 percent. Of the four growing season months during which hydrology is most important for wetlands (May to August), August represents the least influential.

Eliminating navigation service in August and September would retain more water in the reservoirs during these months and markedly reduce downstream flows. Lower August flows would increase the opportunity for plant colonization of exposed sediments. In years when the following spring flows provided suitable moisture conditions for survival of early-growth wetland plants, wetland vegetation would become successfully established. Simulations indicate increased mean annual wetland acreage in the following upper river reaches: Garrison, Fort Randall, and Gavins Point (Rec River) reaches (reduced flood control constraints, Figures 4-93 through 4-117). Very little, if any, effect would occur in the lower river reaches. The opportunity for successful establishment of emergent marsh or scrub-shrub vegetation, however, would be limited by the very high October flows that would typically follow the low August and September flows. High October flows would tend to scour away the fragile recently rooted wetland plants, a process which was not included in the wetland and riparian model. Thus, in years with relatively dry fall seasons, the shortened navigation season would probably increase wetland acreage in the Garrison, Fort Randall and Gavins Point Dam (Rec River) reaches, but in most years the shortened navigation season would not significantly affect wetland resources.

Reduction of the navigation season to 6 months would retain more water in Fort Peck Lake in late summer, possibly reducing the opportunity for wetland establishment on exposed sediments. Simulation studies indicate wetland acreage reductions when flood control constraints are eliminated but not when constraints are reduced.

At a permanent pool level of 44 MAF and perhaps other levels, elimination of navigation service in August and September would change the effect of flood control constraints on wetland acreage at Fort Peck Lake delta. Under these conditions and a spring navigation service level of 55 or 65 kcfs, elimination of the flood control constraints would tend to decrease wetland acreage.

Simulation results indicate that eliminating navigation in August and September would slightly increase mean annual wetland acreage under certain conditions (spring navigation service levels and minimum permanent pool levels). The effect occurs when flood control constraints are eliminated but not when constraints are only reduced.

Reduction of the navigation season to 6 months would change the effect of eliminating flood control constraints on wetlands at Lake Sakakawea. Elimination of flood control constraints, when combined with elimination of navigation during October and November, would tend to decrease wetland acreage depending on permanent pool level and spring navigation service level.

At Lake Oahe (Missouri River delta), eliminating navigation service in August and September would tend to increase wetland acreage, if spring navigation service were maintained at 55 kcfs, but possibly reduce acreage if spring navigation flows were maintained at 45 or 65 kcfs. Eliminating navigation support in these two months would also affect how flood control constraints influence wetland acreage.

The effects of eliminating August and September service on wetland resources at the Lake Oahe tributary deltas would vary depending on minimum permanent pool level and spring navigation service level.

4.3.2 Riparian Vegetation

Mean (96-year) annual woody riparian vegetation of Native Fish alternatives are sorted by permanent pool level, spring service level, navigation season length, and flood control constraints (Figures 4-135 to 4-154).

4.3.2.1 Effect of Increasing Spring Service Levels. Increasing spring season flows decreases simulated mean annual acreage of woody riparian vegetation in the Missouri River system by about 10 percent, depending on permanent pool level, navigation season length, and flood control constraints (Figures 4-135 through 4-139). The decreases in acreage occur almost entirely in the lower river (Figures 4-150 through 4-154), where greater spring service levels would convert riparian vegetation to wetland types. Increasing spring flows would increase acreage of riparian vegetation in the deltas (Figures 4-145 through 4-149), primarily at Lake Oahe where most of the delta riparian acreage occurs. Increasing flows decrease lake elevations, which tends to reduce moisture levels supporting shoreline wetlands and, under certain conditions, to convert delta wetland types to riparian. Higher spring service levels would cause no apparent major changes in simulated acreage of riparian vegetation in the upper river (riverine) system (Figures 4-140 through 4-144).

Effects of higher spring service levels at individual reaches follow trends identified for the three major sub-systems (upper, delta, and lower), as summarized below.

Spring Service Level with Greatest Acreage of Riparian Vegetation

	Permanent Pool				
	A	B	C	D	E
Fort Peck Delta	45	45	45	45	45
Fort Peck Reach	35	35	35	35	35
Lake Sakakawea Delta	65	MIXED	MIXED	MIXED	45
Garrison Reach	35	35	35	35	MIXED
Lake Oahe Delta	65	65	65	65	65
Lake Oahe Trb. Delta	65	65	65	65	65
Fort Randall Reach	45	45	45	45	45
Gavins Reach	45	45	45	45	45
Sioux City Reach	45	45	45	45	45
Omaha	45	45	45	45	45
St. Joseph Reach	35	35	35	35	35

A "45," "55," or "65" indicates the spring service level (kcfs) associated with at least five of the seven maximum mean acreage values for that reach and permanent pool level; "MIXED" indicates that no single spring service level associated with maximum riparian vegetation acreage in more than four of the seven maximum alternatives. Spring service levels would influence flows in the Fort Peck reach relatively little, and therefore affect riparian acreage there very slightly.

4.3.2.2 Effects of Flood Control Constraints. Reduction of flood control constraints on higher spring service levels tends to reduce mean annual acreage of woody riparian vegetation in the Missouri River system less than 5 percent (Figures 4-58 through 4-62). Effects appear similar for all three higher spring service levels, and differ little with permanent pool level. Elimination of constraints causes little further decrease in riparian vegetation acreage and in some instances reverses by small amounts the decreasing trend caused by constraint reduction (Figure 4-59, 65 kcfs). When combined with a shortened navigation season, elimination of constraints causes no appreciable change in riparian acreage compared to alternatives with reduced constraints.

Reductions in acreage in the entire river system are attributable to reductions in the lower river (Figures 4-73 through 4-77), which exceed the slight increases in acreage resulting in the deltas (Figures 4-68 through 4-72). Reduction or elimination of flood control constraints causes little change in acreage in the upper (riverine) river system (Figures 4-63 through 4-67).

Trends exhibited within individual reaches generally follow those described for the upper (riverine), delta, and lower systems. At Fort Peck reach, eliminating constraints instead of just reducing them, increases riparian vegetation acreage by 1,000 to 3,000 acres when permanent pool is at the E level and navigation is not supported in August or September (Figure 4-155). This combination of eliminated constraints, 48-MAF permanent pool and shortened navigation season, produces river stages that convert substantial wetland acreage to riparian (compare Figure 4-155 with Figure 4-87).

4.3.2.3 Effect of Shortened Navigation Season. A shortened navigation season would have little if any effect on riparian vegetation of individual reaches or on the entire river system. As noted above, eliminating August and September from the navigation season can evidently increase riparian vegetation in the Fort Peck reach, if combined with an E permanent pool and elimination of flood control constraints (Figure 4-155).

4.4 EFFECT OF PERMANENT POOL

4.4.1 Wetlands

Simulated mean annual wetland acreages in the Missouri River Mainstem System greater than 162,000 result from alternatives with the highest permanent pool level, 48 MAF (G). Conversely, mean acreages less than 156,000 result mostly from alternatives with lower permanent pools (Figure 4-156). With the exception of high and low extremes, permanent pool has little effect on simulated acreage for the entire system.

Effects of permanent pool on simulated mean annual wetland acreage (averaged according to non-navigation service level) on the upper (riverine), delta and lower systems can be examined in Figures 4-24 through 4-26. Except for increased acreage associated with the E pool, permanent pool influences simulated mean annual wetland acreage only in the lower system, where mean acreage increase slightly with increasing pool. This effect on the lower river mostly results from increases in the Sioux City reach.

Effects of permanent pool on mean annual wetland acreage of individual reaches are summarized in Table 4-10. In most reaches, effects are negligible or slight. In the Fort Randall, Gavins Point, and Sioux City reaches, increasing permanent pool tends to increase mean annual wetland acreage. Higher permanent pool levels allow higher flows to resume sooner in a drought recovery period, such as the early 1940s. Wetland acreages in the Sioux City reach during the early 1940s increase rapidly in response to the earlier resumption of higher flows resulting from higher pool alternatives (Figures 4-158 and 4-159). The higher flows inundate or saturate areas that had earlier converted to riparian or exposed shore during the drought, and revert them back to wetland. The earlier increase during drought recovery accounts for the increase in 96-year means.

4.4.2 Riparian Vegetation

Increasing permanent pool from 18 to 31 MAF causes little or no change in simulated mean annual acreage of woody riparian vegetation in the entire river system. Increasing permanent pool to 38 MAF or greater tends to decrease riparian acreage through conversion to wetland (Figure 4-157).

Increasing permanent pool reduces woody riparian vegetation in the upper (riverine), delta, and lower systems, but more so in the lower system (Figures 4-44 through 4-46). Permanent pool level affects timing and magnitude of river flows and lake elevations, particularly during drought and drought recovery. In the lake deltas, higher permanent pool levels would generally maintain higher lake levels, which can affect riparian habitat by reducing the number of years during extended drought when shoreline wetlands convert to riparian vegetation. The complex effects of permanent pool level on timing, magnitude, and frequency of lake elevations and river flows, however, likely causes the greatest impact on riparian acreage in the deltas and upper and lower river reaches.

Effects of permanent pool levels on woody riparian vegetation acreage simulated for individual reaches can be examined in Figures 4-47 through 4-57. At Fort Peck Lake delta, Lake Sakakawea delta, Garrison reach, Gavins Point reach, and St. Joseph reach, effects appear negligible. At Fort Peck, Sioux City, and Omaha reaches, increasing permanent pool clearly tends to decrease mean annual woody riparian acreage. At Lake Oahe (mainstem and tributary deltas) and Fort Randall reach, increasing pool also decreases riparian acreage but by small amounts. Increasing permanent pool tends to decrease flows in the Fort Peck reach during 1930 to 1965 (Figure 4-160), when acreage resulting from higher and lower permanent pools differ the greatest (alternative EBAE21 compared to alternative ABAE21, Figure 4-161). During the first 12 years of the 1930 to 1965 interval, alternative EBAE21 produces lower monthly flows with less fluctuations, initially supporting greater riparian acreage (1937 to 1942). The high flows produced by the EBAE21 alternative in 1943 convert riparian vegetation to wetland, and thus reduce riparian acreage compared to the ABAE21 alternative (1944 to 1949, Figure 4-161). The earlier occurrence of high-flow years following drought results from maintaining reservoirs at higher pool levels. The subsequent greater riparian acreage associated with the ABAE21 alternative (especially 1959 to 1966) results from relatively small differences in monthly flows (Figure 4-160).

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ABAA10	154.6	46.6	76.1	31.9
ABAA11	154.1	48.5	76.5	29.0
ABAA20	156.0	47.2	76.8	32.0
AAAA21	158.0	49.2	78.1	30.7
AAAB21	158.0	49.2	78.1	30.7
AAAC21	158.0	49.2	78.1	30.7
AAAD21	158.0	49.2	78.1	30.7
AAAE21	158.0	49.2	78.1	30.7
AABB21	157.5	49.1	77.9	30.4
AABC21	157.5	49.1	77.9	30.4
AABD21	157.5	49.1	77.9	30.4
AABE21	157.4	49.1	77.9	30.3
AACC21	157.3	49.0	77.8	30.5
AACD21	157.3	49.0	77.8	30.5
AACE21	157.3	49.0	77.8	30.5
AADD21	159.6	51.6	78.1	29.9
AADE21	157.0	48.9	78.0	30.1
AAEE21	154.3	47.5	77.3	29.4
ABAA21	156.7	48.5	77.9	30.3
ABAB21	156.7	48.5	77.9	30.3
ABAC21	156.7	48.5	77.9	30.3
ABAD21	156.7	48.5	77.9	30.3
ABAE21	156.7	48.5	77.9	30.3
ABBB21	157.0	49.0	77.9	30.0
ABBC21	157.9	49.6	77.9	30.4
ABBD21	158.4	50.0	78.0	30.4
ABBE21	156.2	48.1	77.9	30.2
ABCC21	158.5	50.6	77.9	30.0
ABCD21	158.7	51.1	78.0	29.7
ABCE21	155.4	47.9	77.8	29.7
ABDD21	159.6	51.2	78.0	30.4
ABDE21	156.0	48.0	77.7	30.2
ACAA21	156.2	48.4	77.6	30.2
ACAB21	156.5	48.7	77.7	30.0
ACAC21	158.8	50.5	77.9	30.4
ACAD21	158.7	50.8	77.9	29.9
ACAE21	155.9	48.2	77.7	30.0
ACBB21	157.3	49.1	77.7	30.5

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ACBC21	158.7	50.8	77.7	30.1
ACBD21	158.3	50.6	77.8	29.9
ACBE21	156.7	48.5	77.8	30.4
ACCC21	158.8	51.0	77.8	30.0
ACCD21	159.2	51.1	77.9	30.2
ACCE21	155.7	47.9	77.7	30.2
ACDD21	159.2	51.0	77.7	30.5
ACDE21	156.6	48.7	77.4	30.5
ADAA21	157.8	48.7	77.7	31.4
ADAB21	158.9	49.8	77.6	31.5
ADAC21	160.5	51.1	77.8	31.5
ADAD21	159.1	50.8	77.7	30.5
ADAE21	157.1	48.3	77.7	31.1
ADBB21	158.2	49.0	77.6	31.6
ADBC21	158.8	50.5	77.7	30.6
ADBD21	159.6	50.9	77.8	30.9
ADBE21	156.8	47.7	77.5	31.6
ADCC21	159.4	50.7	77.6	31.2
ADCD21	158.6	49.6	77.8	31.2
ADCE21	154.8	47.3	77.2	30.2
ADDD21	156.4	49.1	77.2	30.1
ADDE21	154.0	47.4	76.6	30.0
BAAA21	157.6	48.7	78.1	30.8
BAAB21	157.6	48.7	78.1	30.8
BAAC21	157.6	48.7	78.1	30.8
BAAD21	157.6	48.7	78.1	30.8
BAAE21	157.6	48.7	78.1	30.8
BABB21	158.3	49.3	78.0	30.9
BABC21	159.5	50.3	78.1	31.2
BABD21	159.5	50.3	78.1	31.1
BABE21	157.4	49.2	78.1	30.2
BACC21	160.6	51.8	78.2	30.7
BACD21	160.8	51.9	78.2	30.7
BACE21	157.7	49.1	78.1	30.5
BADD21	160.6	51.9	78.1	30.6
BADE21	157.7	48.8	78.0	30.9
BBAA21	158.2	49.0	78.1	31.1
BBAB21	158.4	49.5	78.1	30.8

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Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
BBAC21	159.8	51.3	78.1	30.3
BBAD21	159.6	51.3	78.1	30.2
BBAE21	157.1	48.6	78.0	30.5
BBBB21	157.7	49.6	78.0	30.1
BBBC21	159.6	51.2	78.0	30.4
BBBD21	159.3	51.0	78.1	30.2
BBBE21	156.6	48.5	77.9	30.2
BBCC21	159.2	51.2	78.0	30.0
BBCD21	159.0	51.0	78.0	29.9
BBCE21	156.8	48.4	77.9	30.4
BBDD21	158.7	51.0	78.0	29.7
BBDE21	155.5	47.8	77.8	29.9
BCAA21	157.7	48.8	78.0	31.0
BCAB21	158.0	49.3	78.0	30.7
BCAC21	159.0	51.0	78.0	30.1
BCAD21	159.3	51.0	78.0	30.3
BCAE21	156.7	48.2	77.8	30.6
BCBB21	158.7	50.0	77.9	30.7
BCBC21	159.2	50.7	77.9	30.6
BCBD21	159.0	50.6	78.0	30.4
BCBE21	157.4	48.5	77.9	31.0
BCCC21	158.7	50.9	77.8	29.9
BCCD21	159.1	51.0	77.9	30.2
BCCE21	155.2	47.5	77.6	30.1
BCDD21	159.8	50.8	78.1	30.8
BCDE21	154.9	47.8	77.4	29.7
BDAA21	158.1	47.7	77.4	33.1
BDAB21	159.2	49.8	77.9	31.5
BDAC21	158.8	50.3	77.8	30.7
BDAD21	158.2	49.8	77.8	30.6
BDAE21	157.6	48.1	78.0	31.4
BDBB21	157.7	48.7	77.6	31.4
BDBC21	158.4	50.2	77.7	30.6
BDBD21	158.6	50.2	77.8	30.6
BDBE21	155.6	47.7	77.4	30.4
BDCC21	158.2	50.1	77.7	30.4
BDCD21	160.2	50.5	78.0	31.7
BDCE21	155.9	47.7	77.5	30.8

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
BDDD21	156.8	49.6	76.9	30.4
CAAA21	158.5	49.5	78.4	30.6
CAAB21	159.2	50.2	78.5	30.6
CAAC21	160.9	51.8	78.5	30.6
CAAD21	160.5	51.7	78.5	30.2
CAAE21	158.0	49.2	78.4	30.5
CABB21	158.9	50.0	78.4	30.4
CABC21	159.3	50.7	78.2	30.3
CABD21	159.2	50.1	78.5	30.6
CABE21	156.5	47.7	78.3	30.4
CACC21	160.0	50.7	78.4	30.8
CACD21	159.8	50.7	78.5	30.7
CACE21	157.0	47.9	78.3	30.8
CADD21	159.3	50.3	78.4	30.6
CADE21	156.2	47.8	78.1	30.3
CBAA21	158.8	49.6	78.0	31.2
CBAB21	159.2	50.4	77.9	31.0
CBAC21	160.9	51.7	78.1	31.1
CBAD21	160.3	51.0	78.2	31.1
CBAE21	157.2	48.4	78.1	30.8
CBBB21	158.8	50.4	78.0	30.4
CBBC21	159.6	50.8	78.0	30.8
CBBD21	160.1	51.2	78.1	30.8
CBBE21	157.1	48.6	77.9	30.6
CBCC21	159.7	50.8	77.9	31.1
CBCD21	158.6	50.2	78.1	30.3
CBCE21	156.5	48.1	77.8	30.5
CBDD21	157.5	49.9	77.5	30.1
CBDE21	154.8	47.4	77.5	29.9
CCAA21	156.7	48.9	77.9	30.0
CCAB21	158.2	49.9	78.0	30.2
CCAC21	158.4	50.3	78.0	30.2
CCAD21	158.3	50.4	78.0	29.9
CCAE21	156.0	47.9	77.9	30.2
CCBB21	157.1	49.1	77.9	30.1
CCBC21	158.5	50.7	77.8	30.0
CCBD21	158.0	50.2	78.0	29.8
CCBE21	155.6	47.7	77.5	30.4

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
CCCC21	158.5	50.6	77.8	30.1
CCCD21	157.5	49.7	77.3	30.5
CCCE21	155.4	47.7	77.5	30.2
CCDD21	158.2	50.5	77.2	30.4
CDAA21	156.6	47.7	77.8	31.1
CDAB21	157.7	48.7	77.9	31.1
CDAC21	158.7	49.8	77.9	31.0
CDAD21	158.8	50.3	77.9	30.5
CDAE21	155.7	47.4	77.7	30.7
CDBB21	157.9	49.1	77.7	31.0
CDBC21	158.5	50.3	77.7	30.5
CDBD21	157.4	49.6	77.4	30.4
CDBE21	155.7	47.5	77.4	30.7
CDCC21	157.7	50.1	77.3	30.4
CDCD21	157.5	49.8	77.3	30.4
CDDD21	156.6	49.1	76.8	30.7
DAAA21	157.6	48.3	78.6	30.7
DAAB21	157.9	49.0	78.6	30.3
DAAC21	160.3	51.0	78.8	30.5
DAAD21	160.1	50.4	78.8	30.8
DAAE21	156.5	47.8	78.6	30.2
DABB21	158.8	49.1	78.6	31.2
DABC21	159.3	49.9	78.6	30.8
DABD21	159.0	47.9	78.1	32.9
DABE21	157.2	47.8	78.6	30.8
DACC21	159.7	50.4	78.5	30.8
DACD21	159.8	50.4	78.5	30.9
DACE21	155.2	46.7	78.6	29.9
DADD21	159.0	50.2	78.4	30.4
DBAA21	158.6	49.1	78.4	31.1
DBAB21	159.4	50.0	78.4	31.0
DBAC21	160.9	50.9	78.6	31.4
DBAD21	160.5	50.9	78.6	31.0
DBAE21	158.3	48.5	78.6	31.2
DBBB21	160.3	50.0	78.5	31.7
DBBC21	160.5	50.7	78.3	31.5
DBBD21	160.9	51.3	78.5	31.1
DBBE21	156.6	47.4	78.4	30.7

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
DBCC21	159.8	50.5	77.9	31.3
DBCD21	159.6	51.0	78.0	30.6
DBDD21	157.1	48.5	77.7	30.9
DCAA21	157.0	48.5	78.3	30.2
DCAB21	158.6	49.8	78.3	30.5
DCAC21	158.9	50.3	78.2	30.4
DCAD21	159.2	50.6	78.2	30.4
DCAE21	156.1	47.1	78.4	30.7
DCBB21	156.1	48.3	77.9	29.9
DCBC21	157.4	50.0	77.8	29.7
DCBD21	158.4	50.2	78.0	30.2
DCBE21	156.3	48.7	77.9	29.6
DCCC21	158.3	50.1	78.1	30.1
DCCD21	157.9	49.6	77.9	30.4
DCDD21	157.7	49.9	77.5	30.3
DDAA21	155.9	47.2	77.8	31.0
DDAB21	157.1	48.3	78.3	30.6
DDAC21	158.1	49.2	78.4	30.4
DDAD21	158.4	49.4	78.4	30.6
DDAE21	156.6	48.5	77.9	30.2
DDBB21	156.0	47.8	77.9	30.2
DDBC21	158.1	49.5	78.3	30.3
DDBD21	157.2	48.9	77.8	30.5
DDCC21	157.0	48.7	77.8	30.5
DDCD21	157.9	50.0	77.8	30.1
EAAA21	159.5	50.0	79.2	30.2
EAAB21	160.7	51.1	79.2	30.4
EAAC21	160.7	51.2	79.2	30.4
EAAD21	160.7	50.8	78.7	31.3
EAAE21	157.0	47.8	79.1	30.1
EABB21	159.2	49.4	78.7	31.1
EABC21	160.0	49.9	78.7	31.4
EABD21	159.1	50.0	78.9	30.2
EABE21	156.8	47.2	78.8	30.8
EACC21	158.5	49.4	78.6	30.4
EACD21	159.2	50.0	78.5	30.7
EADD21	156.5	48.8	78.1	29.6
EBAA21	158.3	48.8	79.0	30.5

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
EBAB21	159.0	49.5	78.4	31.1
EBAC21	160.8	52.2	78.2	30.4
EBAD21	159.1	50.5	78.4	30.1
EBAE21	156.0	47.3	78.7	30.1
EBBB21	159.5	50.6	78.2	30.6
EBBC21	160.4	51.3	78.7	30.4
EBBD21	159.4	50.2	78.7	30.5
EBCC21	157.6	49.4	78.4	29.8
EBCD21	157.6	49.9	77.9	29.8
ECAA21	158.9	50.0	78.3	30.6
ECAB21	159.6	50.7	78.2	30.6
ECAC21	159.1	50.7	78.3	30.0
ECAD21	158.8	50.7	78.3	29.7
ECBB21	158.5	49.4	78.5	30.7
ECBC21	159.1	50.8	78.2	30.2
ECBD21	158.3	50.0	77.7	30.6
ECCC21	158.3	49.9	78.2	30.2
ECCD21	158.4	49.9	77.9	30.6
EDAA21	159.3	48.2	78.4	32.7
EDAB21	159.6	49.0	78.7	32.0
EDAC21	162.2	51.7	78.9	31.6
EDBB21	161.3	50.4	78.9	32.0
EDBC21	158.3	50.1	78.3	29.9
EDBD21	159.5	51.0	78.0	30.5
EDCC21	159.8	50.8	78.2	30.8
GAAA21	160.0	48.2	80.3	31.5
GAAB21	161.7	51.1	80.0	30.6
GAAC21	162.8	52.3	79.9	30.5
GAAD21	163.1	52.5	80.2	30.3
GAAE21	157.3	47.4	79.9	30.0
GABB21	160.8	48.5	79.5	32.8
GABC21	163.0	51.1	79.4	32.5
GABD21	162.8	50.8	79.5	32.4
GACC21	162.9	51.1	79.3	32.5
GACD21	162.5	51.0	80.1	31.4
GBAA21	160.2	48.5	79.4	32.3
GBAB21	160.9	49.2	79.5	32.2
GBAC21	162.8	51.3	79.5	32.0

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
GBAD21	163.7	51.7	79.6	32.4
GBBB21	162.3	48.9	80.5	32.9
GBBC21	162.9	51.3	79.1	32.5
GBBD21	161.6	50.2	79.4	32.0
GBCC21	163.9	51.4	80.3	32.2
GCAA21	160.7	47.1	80.5	33.1
GCAB21	162.3	48.9	79.9	33.6
GCAC21	161.8	49.1	80.1	32.5
GCAD21	163.7	51.1	80.5	32.1
GCBB21	160.4	47.7	79.9	32.8
GDAA21	160.8	47.9	79.9	33.0
ABAE31	163.7	53.9	76.8	33.1
BBAE31	163.4	54.2	77.0	32.1
CBAE31	163.4	54.2	77.2	32.1
DBAE31	163.5	53.8	77.3	32.5
EBAE31	163.6	53.3	77.2	33.1
ABAE32	167.7	53.5	80.6	33.6
BBAE32	167.1	53.3	81.1	32.7
CBAE32	169.2	54.9	81.4	32.9
DBAE32	167.8	53.1	81.7	33.0
EBAE32	169.2	53.3	81.6	34.3
ABAE33	175.0	53.7	86.7	34.6
BBAE33	174.3	53.2	86.7	34.3
CBAE33	176.8	53.7	87.8	35.3
DBAE33	177.5	53.8	87.9	35.7
EBAE33	175.2	52.6	88.8	33.9
ABAE41	165.2	50.7	79.6	34.9
BBAE41	165.9	50.9	80.2	34.8
CBAE41	166.3	51.1	80.7	34.5
DBAE41	165.7	50.9	80.0	34.9
EBAE41	167.0	51.5	79.4	36.1
ABAE42	168.9	51.4	82.9	34.5
BBAE42	170.0	51.2	84.1	34.7
CBAE42	170.0	51.4	84.3	34.4
DBAE42	172.5	52.6	84.4	35.6
EBAE42	168.7	50.5	83.8	34.4
ABAE43	182.0	53.8	90.2	38.1
BBAE43	181.8	53.4	90.7	37.8

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
CBAE43	182.7	54.5	90.4	37.8
DBAE43	183.9	53.5	91.3	39.2
EBAE43	179.7	52.5	90.0	37.2
ABAE51	166.4	51.3	79.4	35.7
BBAE51	166.4	51.2	80.2	35.1
CBAE51	167.7	51.5	80.7	35.5
DBAE51	167.6	51.5	79.4	36.8
EBAE51	166.5	51.5	78.9	36.0
ABAE52	169.0	50.0	84.1	34.9
BBAE52	169.2	50.3	84.6	34.3
CBAE52	169.9	50.6	85.0	34.3
DBAE52	170.1	50.5	83.4	36.2
EBAE52	168.0	50.6	82.3	35.1
ABAE53	177.7	50.8	89.0	37.9
BBAE53	178.4	51.0	89.3	38.0
CBAE53	180.7	51.2	91.2	38.3
DBAE53	180.9	50.1	91.6	39.2
EBAE53	179.6	50.9	89.1	39.5
ABAE61	167.8	52.8	80.2	34.9
BBAE61	169.0	52.7	81.1	35.2
CBAE61	169.4	52.9	81.2	35.2
DBAE61	169.7	52.7	81.3	35.7
EBAE61	167.9	53.5	78.7	35.6
ABAE62	175.1	55.0	83.7	36.4
BBAE62	174.8	55.2	84.2	35.3
CBAE62	175.7	53.9	85.0	36.8
DBAE62	176.3	55.3	85.5	35.6
EBAE62	173.2	53.3	83.4	36.5
ABAE63	182.0	55.8	89.2	36.9
BBAE63	184.4	56.4	90.6	37.4
CBAE63	183.7	55.5	90.6	37.6
DBAE63	185.3	56.6	91.1	37.7
EBAE63	184.7	57.7	90.6	36.5
ABAE71	165.0	50.7	79.6	34.7
BBAE71	166.0	50.9	80.0	35.1
CBAE71	164.4	50.8	80.1	33.5
DBAE71	163.7	50.6	79.2	33.9
EBAE71	166.4	51.2	78.4	36.8

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ABAE72	169.7	52.5	84.0	33.2
BBAE72	169.1	51.5	84.5	33.1
CBAE72	169.3	51.7	85.9	31.7
DBAE72	168.3	50.8	84.3	33.2
EBAE72	168.9	51.0	83.9	34.0
ABAE73	179.5	53.8	90.0	35.7
BBAE73	179.2	53.9	90.4	34.9
CBAE73	180.2	53.9	91.5	34.9
DBAE73	180.7	53.7	91.5	35.5
EBAE73	180.2	54.6	89.3	36.3
ABAE81	166.6	51.0	80.9	34.6
BBAE81	169.1	51.1	82.0	36.0
CBAE81	169.9	51.3	82.2	36.4
DBAE81	169.2	50.9	82.0	36.4
EBAE81	167.5	49.9	81.4	36.2
ABAE82	172.0	51.0	84.2	36.8
BBAE82	171.0	51.2	84.7	35.0
CBAE82	173.0	50.6	85.2	37.1
DBAE82	175.1	51.9	86.0	37.2
EBAE82	169.8	51.7	85.3	32.9
ABAE83	177.8	52.3	88.5	37.0
BBAE83	178.8	53.2	88.8	36.8
CBAE83	178.8	51.3	90.7	36.8
DBAE83	179.7	52.1	90.2	37.4
EBAE83	179.7	52.1	90.8	36.7
ABAE91	165.9	50.2	80.5	35.2
BBAE91	166.9	50.4	80.8	35.7
CBAE91	166.0	50.4	81.3	34.3
DBAE91	164.2	50.0	79.6	34.7
EBAE91	167.8	51.8	79.2	36.8
ABAE92	167.2	49.8	84.4	33.0
BBAE92	166.9	49.9	84.9	32.2
CBAE92	167.7	50.0	85.6	32.2
DBAE92	166.3	49.3	84.0	33.0
EBAE92	168.0	50.0	83.2	34.8
ABAE93	177.2	50.9	89.9	36.3
BBAE93	176.7	50.5	90.6	35.6
CBAE93	178.0	50.8	91.1	36.1

Table 4-1. Average annual wetland acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
DBAE93	178.8	50.4	91.4	36.9
EBAE93	175.9	50.6	89.6	35.6
EVQ2XX	186.4	50.2	95.6	40.5

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ABAA10	107.6	42.3	54.4	10.9
ABAA11	104.8	40.4	54.2	10.1
ABAA20	106.2	42.0	53.6	10.7
AAAA21	101.7	39.2	53.1	9.4
AAAB21	101.7	39.2	53.1	9.4
AAAC21	101.7	39.2	53.1	9.4
AAAD21	101.7	39.2	53.1	9.4
AAAE21	101.7	39.2	53.1	9.4
AABB21	102.1	39.3	53.1	9.7
AABC21	102.1	39.3	53.1	9.7
AABD21	102.1	39.3	53.1	9.7
AABE21	102.1	39.3	53.1	9.7
AACC21	102.2	39.3	53.2	9.7
AACD21	102.2	39.3	53.2	9.7
AACE21	102.2	39.3	53.2	9.7
AADD21	102.4	39.4	53.3	9.7
AADE21	102.3	39.4	53.2	9.7
AAEE21	103.5	40.2	53.5	9.8
ABAA21	102.4	39.5	53.2	9.7
ABAB21	102.4	39.5	53.2	9.7
ABAC21	102.4	39.5	53.2	9.7
ABAD21	102.4	39.5	53.2	9.7
ABAE21	102.4	39.5	53.2	9.7
ABBB21	102.5	39.5	53.2	9.7
ABBC21	102.5	39.5	53.2	9.7
ABBD21	102.5	39.5	53.2	9.7
ABBE21	102.5	39.5	53.2	9.7
ABCC21	102.6	39.6	53.3	9.7
ABCD21	102.6	39.6	53.3	9.8
ABCE21	102.6	39.6	53.3	9.7
ABDD21	102.7	39.6	53.3	9.8
ABDE21	102.9	39.7	53.3	9.8
ACAA21	102.8	39.7	53.4	9.8
ACAB21	102.9	39.7	53.4	9.8
ACAC21	102.7	39.7	53.2	9.7
ACAD21	102.6	39.6	53.3	9.7
ACAE21	102.8	39.7	53.3	9.8
ACBB21	102.8	39.7	53.4	9.7

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ACBC21	102.8	39.6	53.4	9.7
ACBD21	103.0	39.8	53.5	9.8
ACBE21	102.7	39.7	53.3	9.7
ACCC21	102.8	39.6	53.4	9.7
ACCD21	103.0	39.8	53.4	9.8
ACCE21	103.0	40.0	53.3	9.8
ACDD21	102.9	39.7	53.4	9.7
ACDE21	103.6	40.2	53.6	9.8
ADAA21	103.1	39.7	53.6	9.9
ADAB21	103.2	39.7	53.6	9.9
ADAC21	103.0	39.7	53.4	9.9
ADAD21	102.9	39.6	53.5	9.9
ADAE21	102.8	39.6	53.3	9.9
ADBB21	103.2	39.7	53.6	9.9
ADBC21	103.2	39.7	53.7	9.9
ADBD21	103.2	39.8	53.4	10.0
ADBE21	103.2	40.0	53.4	9.9
ADCC21	103.4	39.9	53.6	9.9
ADCD21	103.6	40.0	53.7	9.9
ADCE21	104.1	40.3	53.7	10.1
ADDD21	104.2	40.3	53.8	10.1
ADDE21	104.4	40.3	54.0	10.1
BAAA21	101.7	39.2	53.1	9.4
BAAB21	101.7	39.2	53.1	9.4
BAAC21	101.7	39.2	53.1	9.4
BAAD21	101.7	39.2	53.1	9.4
BAAE21	101.7	39.2	53.1	9.4
BABB21	101.9	39.3	53.1	9.5
BABC21	101.9	39.3	53.1	9.5
BABD21	102.1	39.3	53.2	9.7
BABE21	101.8	39.3	53.1	9.5
BACC21	101.8	39.3	53.0	9.5
BACD21	101.9	39.3	53.1	9.5
BACE21	102.1	39.3	53.1	9.7
BADD21	102.2	39.3	53.2	9.7
BADE21	102.2	39.6	53.1	9.5
BBAA21	102.3	39.5	53.1	9.7
BBAB21	101.9	39.4	53.0	9.5

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
BBAC21	102.0	39.5	53.0	9.5
BBAD21	102.0	39.5	53.1	9.5
BBAE21	102.3	39.5	53.1	9.7
BBBB21	102.2	39.5	53.1	9.5
BBBC21	102.4	39.5	53.2	9.7
BBBD21	102.5	39.6	53.2	9.7
BBBE21	102.1	39.5	53.0	9.5
BBCC21	102.3	39.7	53.1	9.6
BBCD21	102.7	39.8	53.2	9.8
BBCE21	102.6	39.7	53.2	9.8
BBDD21	102.5	39.7	53.1	9.6
BBDE21	103.0	40.1	53.2	9.8
BCAA21	102.7	39.7	53.2	9.8
BCAB21	102.7	39.7	53.2	9.8
BCAC21	102.7	39.7	53.2	9.8
BCAD21	102.6	39.7	53.2	9.7
BCAE21	102.4	39.7	53.1	9.6
BCBB21	102.8	39.8	53.2	9.8
BCBC21	102.6	39.8	53.2	9.6
BCBD21	102.8	39.8	53.2	9.8
BCBE21	102.8	39.9	53.2	9.7
BCCC21	102.6	39.8	53.1	9.6
BCCD21	102.6	39.8	53.2	9.6
BCCE21	102.7	40.1	53.0	9.6
BCDD21	102.9	39.8	53.3	9.8
BCDE21	103.3	40.2	53.3	9.8
BDAA21	104.8	41.1	53.5	10.2
BDAB21	103.0	39.8	53.3	9.9
BDAC21	102.9	39.7	53.3	9.8
BDAD21	102.8	39.8	53.3	9.8
BDAE21	102.9	39.8	53.3	9.9
BDBB21	102.8	39.8	53.4	9.6
BDBC21	102.9	39.9	53.3	9.8
BDBD21	102.9	39.9	53.3	9.8
BDBE21	103.5	40.2	53.3	10.0
BDCC21	103.1	39.9	53.4	9.8
BDCD21	103.2	39.9	53.4	9.9
BDCE21	103.5	40.2	53.3	10.0

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
BDDD21	104.2	40.5	53.6	10.0
CAAA21	101.7	39.3	53.0	9.4
CAAB21	101.6	39.3	52.9	9.4
CAAC21	101.6	39.2	52.9	9.4
CAAD21	101.6	39.3	52.9	9.4
CAAE21	101.7	39.3	53.0	9.4
CABB21	101.7	39.3	52.9	9.4
CABC21	102.1	39.5	53.2	9.5
CABD21	101.9	39.5	53.0	9.5
CABE21	102.0	39.5	53.0	9.5
CACC21	102.0	39.5	53.1	9.5
CACD21	101.9	39.4	53.1	9.4
CACE21	102.1	39.5	53.1	9.5
CADD21	102.0	39.5	53.0	9.5
CADE21	102.0	39.4	53.0	9.5
CBAA21	102.0	39.5	53.0	9.5
CBAB21	102.1	39.5	53.1	9.5
CBAC21	102.0	39.5	53.0	9.5
CBAD21	101.9	39.5	52.9	9.5
CBAE21	101.9	39.5	53.0	9.5
CBBB21	102.1	39.5	53.0	9.7
CBBC21	102.0	39.5	53.1	9.5
CBBD21	102.2	39.5	53.0	9.7
CBBE21	102.0	39.5	53.0	9.5
CBCC21	102.2	39.7	53.0	9.5
CBCD21	102.2	39.7	53.0	9.5
CBCE21	102.1	39.5	53.0	9.6
CBDD21	101.7	39.5	52.6	9.6
CBDE21	102.7	40.0	53.0	9.6
CCAA21	102.5	39.8	53.1	9.6
CCAB21	102.4	39.8	53.1	9.5
CCAC21	102.5	39.8	53.1	9.6
CCAD21	102.2	39.6	53.1	9.5
CCAE21	102.3	39.7	53.0	9.6
CCBB21	102.4	39.8	53.1	9.6
CCBC21	102.5	39.8	53.1	9.6
CCBD21	102.5	39.8	53.2	9.6
CCBE21	102.7	40.0	53.0	9.6

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
CCCC21	102.4	39.6	53.1	9.6
CCCD21	102.3	39.7	53.1	9.6
CCCE21	102.7	40.0	53.0	9.6
CCDD21	102.4	39.7	53.1	9.6
CDAA21	102.7	39.9	53.2	9.6
CDAB21	102.9	39.9	53.1	9.9
CDAC21	102.6	39.8	53.2	9.6
CDAD21	102.4	39.6	53.0	9.7
CDAE21	102.9	40.0	53.1	9.8
CDBB21	102.3	39.4	53.2	9.7
CDBC21	102.6	39.7	53.2	9.8
CDBD21	102.9	39.9	53.2	9.8
CDBE21	102.9	40.0	53.1	9.8
CDCC21	103.2	40.1	53.3	9.8
CDCD21	102.9	39.9	53.2	9.8
CDDD21	103.7	40.4	53.5	9.8
DAAA21	101.4	39.2	52.7	9.4
DAAB21	101.5	39.3	52.8	9.4
DAAC21	100.8	39.1	52.5	9.3
DAAD21	100.9	38.9	52.6	9.3
DAAE21	101.6	39.3	52.8	9.4
DABB21	101.3	39.2	52.7	9.3
DABC21	101.5	39.4	52.8	9.3
DABD21	103.0	40.7	52.5	9.8
DABE21	100.4	38.8	52.3	9.3
DACC21	100.5	38.7	52.5	9.3
DACD21	100.5	38.7	52.5	9.3
DACE21	100.9	39.3	52.2	9.5
DADD21	101.1	39.2	52.4	9.5
DBAA21	100.8	39.0	52.5	9.4
DBAB21	100.9	39.0	52.5	9.4
DBAC21	100.4	38.8	52.3	9.4
DBAD21	100.5	38.8	52.4	9.3
DBAE21	100.4	38.8	52.3	9.4
DBBB21	100.6	38.8	52.4	9.4
DBBC21	100.6	38.8	52.5	9.4
DBBD21	100.3	38.8	52.2	9.3
DBBE21	100.9	39.3	52.1	9.5

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
DBCC21	100.6	38.8	52.4	9.4
DBCD21	101.0	39.2	52.3	9.5
DBDD21	101.3	39.6	52.2	9.5
DCAA21	100.9	39.0	52.5	9.5
DCAB21	100.9	38.8	52.6	9.4
DCAC21	100.8	38.8	52.6	9.4
DCAD21	100.6	38.8	52.4	9.4
DCAE21	100.9	39.3	52.0	9.5
DCBB21	101.3	39.3	52.5	9.5
DCBC21	101.1	39.2	52.5	9.5
DCBD21	101.5	39.3	52.7	9.5
DCBE21	101.6	39.6	52.4	9.6
DCCC21	101.4	39.4	52.5	9.5
DCCD21	101.3	39.6	52.2	9.5
DCDD21	101.9	39.8	52.5	9.6
DDAA21	101.5	39.3	52.7	9.6
DDAB21	101.0	39.1	52.3	9.6
DDAC21	100.9	39.1	52.2	9.6
DDAD21	101.0	39.2	52.2	9.7
DDAE21	101.8	39.6	52.5	9.7
DDBB21	101.4	39.5	52.3	9.6
DDBC21	101.1	39.1	52.3	9.7
DDBD21	101.9	39.6	52.6	9.7
DDCC21	101.7	39.6	52.3	9.7
DDCD21	102.0	39.9	52.4	9.7
EAAA21	98.7	38.0	51.9	8.8
EAAB21	98.7	38.0	51.8	8.9
EAAC21	99.7	38.9	51.9	8.9
EAAD21	100.3	38.9	52.0	9.4
EAAE21	100.1	38.9	52.0	9.3
EABB21	100.1	39.0	52.0	9.1
EABC21	100.4	39.0	52.0	9.4
EABD21	100.6	39.0	52.1	9.5
EABE21	100.7	39.2	52.0	9.4
EACC21	100.3	38.9	52.1	9.3
EACD21	100.6	38.9	52.3	9.4
EADD21	101.0	39.4	52.1	9.5
EBAA21	99.8	38.9	52.0	8.9

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
EBAB21	100.4	38.9	52.2	9.4
EBAC21	99.6	38.0	52.2	9.4
EBAD21	100.4	38.9	52.1	9.4
EBAE21	100.8	39.2	52.1	9.5
EBBB21	99.7	38.1	52.2	9.4
EBBC21	100.7	39.0	52.2	9.5
EBBD21	100.6	39.0	52.2	9.4
EBCC21	101.1	39.4	52.2	9.5
EBCD21	101.1	39.4	52.2	9.5
ECAA21	99.5	38.0	52.1	9.4
ECAB21	99.7	38.1	52.2	9.4
ECAC21	100.7	39.0	52.3	9.5
ECAD21	100.0	38.4	52.1	9.5
ECBB21	100.8	39.0	52.3	9.5
ECBC21	100.1	38.4	52.2	9.5
ECBD21	101.3	39.5	52.3	9.5
ECCC21	101.4	39.6	52.2	9.6
ECCD21	101.3	39.7	52.1	9.6
EDAA21	100.9	39.4	52.1	9.5
EDAB21	101.1	39.4	52.2	9.5
EDAC21	100.0	38.4	52.0	9.5
EDBB21	100.0	38.4	52.1	9.5
EDBC21	101.5	39.6	52.2	9.6
EDBD21	100.5	38.8	52.1	9.6
EDCC21	100.6	38.8	52.1	9.7
GAAA21	99.3	38.8	51.1	9.5
GAAB21	97.7	37.7	51.2	8.8
GAAC21	98.2	37.7	51.2	9.3
GAAD21	97.9	37.7	51.1	9.1
GAAE21	99.5	38.9	51.2	9.4
GABB21	98.1	38.3	50.6	9.2
GABC21	98.3	38.3	50.8	9.2
GABD21	98.4	38.3	50.8	9.3
GACC21	98.7	38.4	51.0	9.3
GACD21	98.3	38.3	50.7	9.3
GBAA21	98.9	38.4	51.2	9.2
GBAB21	98.7	38.5	51.0	9.3
GBAC21	98.8	38.4	51.2	9.2

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
GBAD21	99.0	38.4	51.2	9.4
GBBB21	97.9	38.3	50.3	9.4
GBBC21	99.6	38.5	51.5	9.6
GBBD21	100.7	39.5	51.5	9.7
GBCC21	98.6	38.4	50.6	9.6
GCAA21	98.0	38.4	50.2	9.4
GCAB21	98.6	38.4	50.6	9.5
GCAC21	99.7	39.4	50.7	9.6
GCAD21	98.5	38.4	50.5	9.6
GCBB21	99.7	39.4	50.8	9.6
GDAA21	98.6	38.3	50.8	9.5
ABAE31	100.4	36.3	54.5	9.6
BBAE31	100.1	36.2	54.3	9.6
CBAE31	100.2	36.2	54.4	9.6
DBAE31	100.0	36.6	54.0	9.4
EBAE31	99.0	36.2	53.5	9.3
ABAE32	96.9	36.4	50.3	10.3
BBAE32	96.7	36.3	50.2	10.2
CBAE32	96.5	36.3	50.1	10.2
DBAE32	95.7	36.7	48.7	10.3
EBAE32	94.0	36.3	48.1	9.7
ABAE33	92.1	36.1	45.1	10.9
BBAE33	92.1	36.1	45.2	10.8
CBAE33	90.5	36.0	43.8	10.8
DBAE33	90.6	36.0	43.9	10.6
EBAE33	90.4	37.0	42.7	10.7
ABAE41	97.4	36.3	51.3	9.9
BBAE41	96.7	36.2	50.8	9.7
CBAE41	96.1	36.2	50.2	9.7
DBAE41	96.2	36.7	49.7	9.8
EBAE41	95.2	36.1	49.5	9.6
ABAE42	94.2	36.2	47.5	10.6
BBAE42	93.4	36.2	46.9	10.4
CBAE42	93.0	36.1	46.7	10.3
DBAE42	92.1	36.1	45.6	10.4
EBAE42	91.2	36.1	45.3	9.8
ABAE43	90.0	36.2	42.7	11.1
BBAE43	89.2	36.2	42.0	11.1

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
CBAE43	89.1	36.1	42.0	11.1
DBAE43	87.6	36.1	40.7	10.8
EBAE43	88.3	36.7	40.4	11.2
ABAE51	96.5	36.2	49.9	10.4
BBAE51	95.6	36.2	49.3	10.1
CBAE51	95.0	36.2	48.7	10.1
DBAE51	94.9	36.5	48.3	10.0
EBAE51	94.0	36.2	47.8	10.0
ABAE52	93.6	36.2	46.5	11.0
BBAE52	93.0	36.1	45.9	10.9
CBAE52	91.9	36.1	44.9	10.9
DBAE52	91.8	36.5	44.5	10.8
EBAE52	90.9	36.1	44.4	10.4
ABAE53	90.1	36.1	42.4	11.6
BBAE53	89.9	36.1	42.2	11.5
CBAE53	87.9	36.0	40.6	11.4
DBAE53	87.8	36.0	40.3	11.4
EBAE53	87.6	36.0	40.4	11.2
ABAE61	97.2	36.4	51.1	9.7
BBAE61	96.2	36.4	50.4	9.4
CBAE61	95.9	36.4	50.1	9.4
DBAE61	95.7	36.5	49.9	9.4
EBAE61	95.5	36.5	49.7	9.3
ABAE62	93.5	36.1	47.5	10.0
BBAE62	93.1	36.1	47.3	9.8
CBAE62	93.4	37.2	46.5	9.7
DBAE62	92.1	36.2	46.2	9.7
EBAE62	93.1	37.5	45.5	10.1
ABAE63	90.5	36.7	42.8	11.0
BBAE63	88.0	35.9	41.2	11.0
CBAE63	89.1	36.9	41.2	10.9
DBAE63	87.7	35.9	41.0	10.8
EBAE63	87.0	36.3	40.1	10.6
ABAE71	96.4	36.1	50.5	9.8
BBAE71	95.5	36.0	50.1	9.3
CBAE71	94.9	36.0	49.6	9.3
DBAE71	94.4	36.2	49.2	9.0
EBAE71	94.3	36.1	48.9	9.3

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
ABAE72	92.7	35.9	46.6	10.1
BBAE72	92.3	36.0	46.3	10.0
CBAE72	91.3	35.9	45.5	10.0
DBAE72	91.3	36.3	45.3	9.8
EBAE72	90.8	36.0	45.1	9.6
ABAE73	88.1	35.7	41.5	11.0
BBAE73	87.8	35.7	41.2	10.9
CBAE73	86.8	35.7	40.3	10.9
DBAE73	86.5	35.8	40.0	10.7
EBAE73	86.5	35.8	40.1	10.6
ABAE81	96.0	36.3	49.9	9.8
BBAE81	95.5	36.3	49.2	10.0
CBAE81	95.0	36.3	49.0	9.7
DBAE81	94.8	36.4	48.8	9.7
EBAE81	96.3	38.2	47.2	10.8
ABAE82	93.4	36.1	46.7	10.5
BBAE82	93.0	36.1	46.4	10.5
CBAE82	93.4	37.3	45.7	10.4
DBAE82	92.1	36.2	45.5	10.4
EBAE82	94.4	39.0	44.3	11.0
ABAE83	90.8	36.8	42.6	11.5
BBAE83	89.3	35.9	42.0	11.4
CBAE83	89.2	36.9	40.9	11.4
DBAE83	89.1	36.9	40.9	11.3
EBAE83	90.4	39.8	39.2	11.4
ABAE91	95.4	36.1	49.1	10.2
BBAE91	94.5	36.1	48.8	9.6
CBAE91	93.7	36.0	48.1	9.6
DBAE91	93.8	36.3	47.9	9.5
EBAE91	92.9	36.2	47.3	9.4
ABAE92	92.2	35.9	45.7	10.6
BBAE92	91.8	35.9	45.3	10.6
CBAE92	90.8	35.9	44.5	10.4
DBAE92	90.9	36.3	44.4	10.3
EBAE92	90.5	36.1	44.2	10.2
ABAE93	88.5	35.7	41.3	11.5
BBAE93	87.9	35.7	40.7	11.4
CBAE93	86.9	35.7	39.8	11.4

Table 4-2. Average annual riparian acreage in the Mainstem System over the 96-year simulation period (in kilo-acres).

Alternative	Total	Upper River Reaches	Lower River Reaches	Deltas
DBAE93	86.8	35.8	39.8	11.3
EBAE93	87.7	36.5	39.8	11.4
EVQ2XX	79.0	34.9	29.5	14.6

Table 4-3. Effects of modified navigation and intrasystem regulation criteria on mean annual wetland acreage (in thousands of acres).

	Modified Navigation Criteria Effect		Modified Intrasystem Regulation Effect	
Area	ABAA20 1/	ABAA21 2/	ABAA11 1/	ABAA21 3/
Entire System	1.42	2.62	(0.52)	0.68
Upper Reaches	0.63	(0.08)	1.93	1.22
Deltas	0.07	1.28	(2.89)	(1.68)
Lower Reaches	0.72	1.41	0.44	1.14
Fort Peck Delta	0.28	0.04	(0.20)	(0.44)
Fort Peck Reach	(0.11)	0.93	1.53	2.57
Lake Sakakawea Delta	(0.24)	0.02	(0.95)	(0.69)
Garrison Reach	0.24	(0.89)	0.75	(0.37)
Lake Oahe Delta	(0.44)	0.41	(2.06)	(1.21)
Lake Oahe Trib. Deltas	0.46	0.81	0.31	0.66
Fort Randall Reach	0.76	0.03	(0.08)	(0.81)
Gavins Point Reach	(0.26)	(0.15)	(0.27)	(0.16)
Sioux City Reach	0.28	0.60	0.63	0.94
Omaha Reach	0.26	0.52	(0.18)	0.08
St. Joseph Reach	0.18	0.30	(0.01)	0.12

1/ Acreage for alternative ABAA10 subtracted.

2/ Acreage for alternative ABAA11 subtracted.

3/ Acreage for alternative ABAA20 subtracted.

Table 4-4. Effects of modified navigation and intrasystem regulation criteria on mean annual acreage of woody riparian vegetation (in thousands of acres).

	Modified Navigation Criteria Effect		Modified Intrasystem Regulation Effect	
Area	ABAA20 1/	ABAA21 2/	ABAA11 1/	ABAA21 3/
Entire System	(1.45)	(2.35)	(2.88)	(3.78)
Upper Reaches	(0.36)	(0.91)	(1.87)	(2.43)
Deltas	(0.22)	(0.40)	(0.80)	(0.98)
Lower Reaches	(0.88)	(1.04)	(0.21)	(0.37)
Fort Peck Delta	0.00	0.00	(0.01)	(0.01)
Fort Peck Reach	(0.19)	(0.82)	(1.67)	(2.30)
Lake Sakakawea Delta	(0.03)	(0.02)	(0.02)	(0.01)
Garrison Reach	(0.06)	0.00	(0.22)	(0.17)
Lake Oahe Delta	(0.13)	(0.19)	(0.52)	(0.58)
Lake Oahe Trib. Deltas	(0.06)	(0.18)	(0.26)	(0.38)
Fort Randall Reach	(0.11)	(0.08)	0.03	0.06
Gavins Point Reach	0.00	(0.01)	(0.01)	(0.02)
Sioux City Reach	(0.57)	(0.53)	(0.30)	(0.25)
Omaha Reach	(0.09)	(0.24)	0.00	(0.15)
St. Joseph Reach	(0.21)	(0.27)	0.09	0.03

1/ Acreage for alternative ABAA10 subtracted.

2/ Acreage for alternative ABAA11 subtracted.

3/ Acreage for alternative ABAA20 subtracted.

Table 4-5. Summary of effects of nonnavigation service levels on mean annual wetland acreage.

Pool	Million Acre-Feet	Period	Fort Peck Delta	Fort Peck Reach	Lake Sakakawea Delta	Garrison Reach	Lake Oahe Delta 1/	Lake Oahe Trib. Deltas 2/	Fort Randall Reach 3/	Gavins Point Reach 4/	Sioux City Reach	Omaha Reach	St. Joseph Reach
A	18	Winter	◆	-	+	-	-	◆	+	+	◆	◆	-
A	18	Spring-Fall	◆	◆	◆	◆	-	-	◆	◆	◆	◆	-
A	18	Summer	◆	◆	◆	◆	◆	◆	+	+	◆	◆	◆
B	26	Winter	◆	-	+	◆	-	-	◆	◆	-	◆	-
B	26	Spring-Fall	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
B	26	Summer	◆	◆	◆	◆	-	◆	+	+	◆	◆	◆
C	31	Winter	◆	-	+	◆	-	◆	◆	◆	-	◆	◆
C	31	Spring-Fall	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	-
C	31	Summer	◆	◆	◆	◆	-	◆	+	+	◆	◆	◆
D	38	Winter	◆	◆	◆	-	-	◆	◆	◆	◆	◆	◆
D	38	Spring-Fall	◆	◆	◆	◆	-	◆	◆	◆	-	-	◆
D	38	Summer	◆	◆	◆	◆	◆	◆	+	◆	◆	◆	◆
E	44	Winter	-	◆	◆	+	-	+	◆	◆	-	◆	+
E	44	Spring-Fall	-	-	◆	-	-	◆	◆	+	-	◆	◆
E	44	Summer	◆	-	◆	-	◆	-	+	◆	◆	◆	◆
G	48	Winter	◆	◆	+	◆	◆	-	-	◆	◆	◆	-
G	48	Spring-Fall	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
G	48	Summer	◆	◆	-	◆	-	-	+	◆	◆	◆	-

1/ Decreasing winter season trend associated with nonnavigation service increase from 9 to 15 kcfs.

2/ Decreasing trends indicated for permanent pool levels E and G associated with nonnavigation service increase from 12 to 25 kcfs.

3/ Trends indicated for permanent pool levels A, B, C, and D generally associated with nonnavigation service increase from 9 to 15 kcfs.

4/ Trends generally associated with nonnavigation service increase from 9 to 15 kcfs.

+ = Increasing wetland acreage generally associated with increasing nonnavigation service level.

- = Decreasing wetland acreage generally associated with increasing nonnavigation service level.

◆ = No generally consistent relationship apparent between wetland acreage and nonnavigation service level.

Table 4-6. Lake Sakakawea elevations (in feet) from May through August (1919 to 1925) for alternatives ADBE21 and ABBE21.

Year	Month	ADBE21	ABBE21	Difference
1919	May	1842.8	1842.8	0.0
1919	June	1843.4	1843.4	0.0
1919	July	1842.1	1842.2	(0.1)
1919	August	1840.8	1840.9	(0.1)
1920	May	1832.7	1833.1	(0.4)
1920	June	1841.0	1841.2	(0.2)
1920	July	1846.0	1846.3	(0.3)
1920	August	1846.0	1846.3	(0.3)
1921	May	1840.8	1841.0	(0.2)
1921	June	1851.2	1851.4	(0.2)
1921	July	1851.4	1851.6	(0.2)
1921	August	1849.0	1849.2	(0.2)
				0.0
1922	May	1841.5	1841.8	(0.3)
1922	June	1849.1	1849.4	(0.3)
1922	July	1850.7	1850.9	(0.2)
1922	August	1850.1	1850.3	(0.2)
1923	May	1832.5	1832.7	(0.2)
1923	June	1837.0	1837.1	(0.1)
1923	July	1844.6	1844.8	(0.2)
1923	August	1844.8	1845.0	(0.2)
1924	May	1848.6	1848.7	(0.1)
1924	June	1850.0	1850.0	0.0
1924	July	1850.0	1850.0	0.0
1924	August	1848.6	1848.6	0.0

Table 4-7. Summary of effects of minimum nonnavigation service levels on mean annual woody riparian vegetation acreage.

Pool	Million Acre-Feet	Period	Fort Peck Delta	Fort Peck Reach	Lake Sakakawea Delta	Garrison Reach	Lake Oahe Delta	Lake Oahe Trib. Deltas [1/]	Fort Randall Reach [2/]	Gavins Point Reach	Sioux City Reach	Omaha Reach	St. Joseph Reach [2/]
A	18	Winter	◆	◆	◆	◆	+	+	◆	◆	◆	+	+
A	18	Spring-Fall	◆	◆	◆	◆	◆	◆	+	+	◆	◆	◆
A	18	Summer	◆	◆	◆	◆	+	+	◆	◆	◆	◆	□
B	26	Winter	◆	◆	◆	◆	+	+	+	◆	◆	+	+
B	26	Spring-Fall	◆	◆	◆	◆	◆	-	◆	+	◆	◆	+
B	26	Summer	◆	◆	◆	◆	+	◆	◆	◆	◆	◆	□
C	31	Winter	◆	◆	◆	◆	+	◆	+	◆	◆	+	+
C	31	Spring-Fall	◆	◆	◆	◆	◆	◆	◆	+	◆	◆	◆
C	31	Summer	◆	◆	◆	◆	+	◆	◆	◆	◆	◆	□
D	38	Winter	◆	◆	◆	◆	+	◆	+	◆	◆	+	+
D	38	Spring-Fall	◆	◆	◆	◆	+	◆	◆	+	◆	◆	◆
D	38	Summer	◆	◆	◆	◆	◆	◆	+	◆	◆	◆	□
E	44	Winter	◆	◆	◆	◆	+	+	+	◆	◆	+	+
E	44	Spring-Fall	◆	-	◆	◆	◆	+	◆	+	+	◆	+
E	44	Summer	◆	◆	◆	◆	+	◆	+	◆	◆	◆	□
G	48	Winter	◆	◆	◆	◆	◆	+	◆	◆	+	+	+
G	48	Spring-Fall	◆	◆	◆	◆	+	◆	◆	◆	◆	◆	◆
G	48	Summer	◆	-	◆	◆	◆	-	◆	◆	◆	◆	□

1/ Indicated trends mostly associated with nonnavigation service level increase from 9 to 15 kcfs.

2/ Trends detected for alternatives with permanent pool level E associated with nonnavigation service level increase from 9 to 15 kcfs.

+ = Increasing wetland acreage generally associated with increasing nonnavigation service level.

- = Decreasing wetland acreage generally associated with increasing nonnavigation service level.

◆ = No generally consistent relationship apparent between wetland acreage and nonnavigation service level.

□ = There is a nonlinear trend where acreage tends to increase with increasing service level but decreases at higher E and G permanent pool levels.

Table 4-8. Effect of reduced flood control constraints on mean annual wetland acreage during unchanged navigation season (in thousands of acres).

Pool	Flow (kcfs)	Total 1/	Upper Reaches	Lower Reaches	Deltas
A	45	1.45	(3.13)	2.78	1.80
A	55	1.13	(2.06)	2.26	0.93
A	65	7.03	0.11	3.48	3.44
B	45	2.56	(3.33)	3.20	2.69
B	55	2.89	(2.09)	3.01	1.97
B	65	7.57	0.24	3.91	3.43
C	45	2.90	(3.07)	3.50	2.47
C	55	0.82	(3.57)	2.87	1.52
C	65	5.90	0.84	2.59	2.47
D	45	2.20	(2.90)	2.73	2.37
D	55	4.75	(0.56)	2.68	2.62
D	65	6.47	(0.35)	3.35	3.47
E	45	3.35	(1.81)	2.19	2.97
E	55	(0.47)	(2.73)	2.16	0.10
E	65	4.42	(0.16)	1.20	3.38

1/ This value is the difference between the mean annual wetland acreage for alternatives ?BAE31, ?BAE32, and ?BAE33 minus the acreage from the corresponding ?BAE4X alternative.

Table 4-9. Summary of effects of reduced or eliminated flood control constraints on mean annual wetland acreage with navigation season unchanged.

Pool	Flow (kcfs)	Constraint 1/	Fort Peck Lake	Fort Peck Reach	Lake Sakakawea Delta	Garrison Reach	Lake Oahe Delta	Lake Oahe Trib. Deltas	Fort Randall Reach	Gavins Point Dam	Sioux City Reach	Omaha Reach	St. Joseph Reach
A	45	Reduced 2/	◆	◆	◆	-	+	-	-	-	◆	+	◆
A	55	Reduced	+	◆	+	-	◆	-	-	-	◆	+	◆
A	65	Reduced	◆	◆	◆	+	+	+	◆	◆	+	◆	◆
A		3/											
A	45	Eliminated	+	◆	◆	◆	+	◆	◆	+	-	◆	◆
A	55	Eliminated	◆	◆	◆	+	+	◆	-	-	+	◆	◆
A	65	Eliminated	◆	◆	◆	+	◆	-	-	-	-	◆	◆
B	45	Reduced	◆	◆	◆	-	+	◆	-	-	◆	+	◆
B	55	Reduced	+	◆	+	-	◆	◆	-	-	+	+	◆
B	65	Reduced	◆	◆	◆	◆	+	+	◆	◆	+	◆	◆
B	45	Eliminated	+	◆	-	◆	◆	◆	◆	+	-	◆	◆
B	55	Eliminated	◆	◆	◆	+	+	-	-	-	+	◆	◆
B	65	Eliminated	◆	◆	◆	+	◆	◆	-	-	◆	◆	◆
C	45	Reduced	◆	◆	◆	-	+	-	-	-	◆	+	◆
C	55	Reduced	+	◆	+	-	◆	-	◆	-	◆	+	◆
C	65	Reduced	◆	◆	◆	+	+	-	◆	◆	+	◆	◆
C	45	Eliminated	+	◆	◆	◆	◆	◆	◆	+	-	◆	◆
C	55	Eliminated	◆	◆	◆	+	+	-	◆	-	◆	◆	◆
C	65	Eliminated	◆	◆	◆	-	◆	+	-	-	◆	◆	◆
D	45	Reduced	◆	◆	◆	-	+	-	-	-	-	+	◆
D	55	Reduced	+	◆	+	+	+	-	-	-	◆	+	◆
D	65	Reduced	◆	◆	◆	+	+	+	◆	◆	+	◆	◆
D	45	Eliminated	+	◆	◆	+	+	+	◆	+	-	◆	◆
D	55	Eliminated	◆	◆	-	-	+	+	◆	-	-	◆	◆
D	65	Eliminated	◆	◆	-	◆	◆	+	-	-	-	◆	◆
E	45	Reduced	◆	◆	-	-	+	+	-	-	-	+	◆
E	55	Reduced	+	◆	◆	-	+	-	-	-	◆	+	◆
E	65	Reduced	◆	◆	+	+	+	+	◆	-	◆	◆	◆
E	45	Eliminated	+	◆	-	-	◆	◆	◆	+	-	◆	◆
E	55	Eliminated	◆	◆	◆	◆	◆	+	◆	+	-	◆	◆
E	65	Eliminated	◆	+	+	-	◆	-	-	-	-	◆	◆

1/ - Signifies a greater than 5-percent decrease.
◆ Signifies no change or a change of less than 5-percent.

2/ + Signifies a greater than 5-percent increase (approximately) in acreage resulting from the alternative with REDUCED flood control constraints compared to the same alternative with spring navigation service but existing flood control limits.

3/ + Signifies a greater than 5-percent increase (approximately) in acreage resulting from the alternative with flood control constraints ELIMINATED compared to the same alternative with spring navigation service but existing flood control limits.

Table 4-10. Permanent pool levels and nonnavigation service levels associated with maximum and minimum means of mean annual wetland acreage.

	Highest (permanent pool / nonnavigation flow)			Lowest (permanent pool / nonnavigation flow)		
Area	Winter	Spring & Fall	Summer	Winter	Spring & Fall	Summer
Fort Peck Lake	B / A, C	A / E	B / A	G / A	G / C	G / E
Fort Peck Reach	E / C	E / A	E / A	G / C	G / B	G / E
Lake Sakakawea Delta	G / D	G / C	G / A	A / A	E / D	G / E
Garrison Reach	A / A	B / B, C, D	C / A	E / A	E / D	E / E
Lake Oahe Delta	G / C	G / B	G / B	E / C	A / E	C / E
Lake Oahe Tribs.	E / D	G / C	G / B	B / D	A / E	E / E
Fort Randall Reach	G / B	G / C	G / C, D	G / D	A / E	E / A
Gavins Point Reach	E, G / A, B, C	G / C	E, G / B, C	A / A	A / E	ALL / E
Sioux City Reach	G / C	G / A	G / A, E	A / D	A / E	A / E
Omaha Reach	G / D	G / C	G / A, D	D / D	D / D	D / C, D
St. Joseph Reach	A / A	A / A	G / E	D / D	E / D	D / E

Note: Here is an example of how highest and lowest mean wetland acreages were derived.

For the Fort Peck Lake Delta, two of the 28 means sorted by winter nonnavigation service (see Figure 4-27) exceed the other 26. One represents the mean of the mean annual wetland acreage simulated for all BA??21 alternatives; the other represents the corresponding mean of all BC??21 alternatives where "?" can be any summer or spring and fall service level.

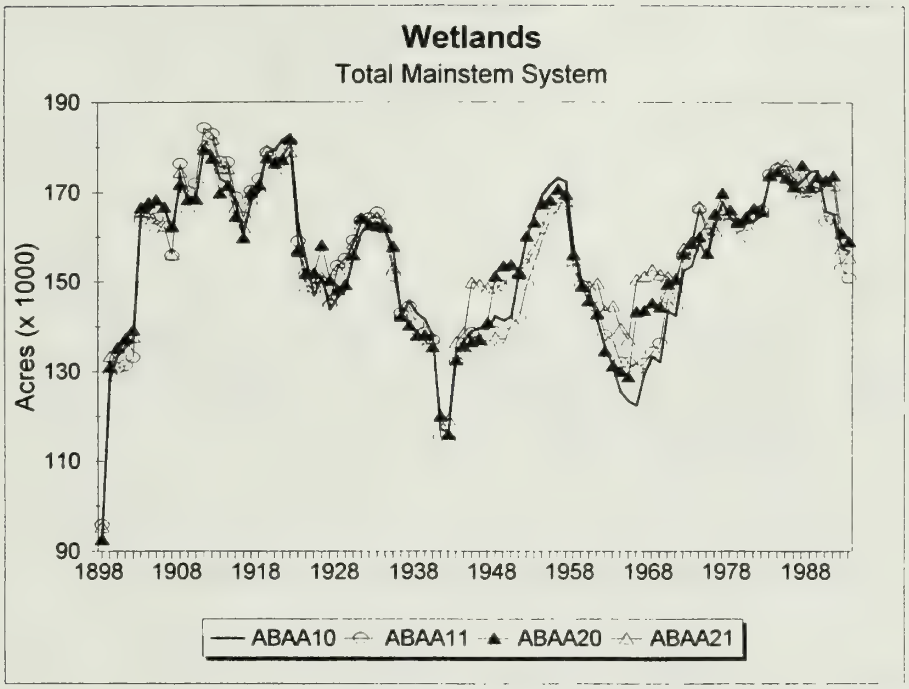

Figure 4-1. Average annual wetland acreage of the entire Missouri River system over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

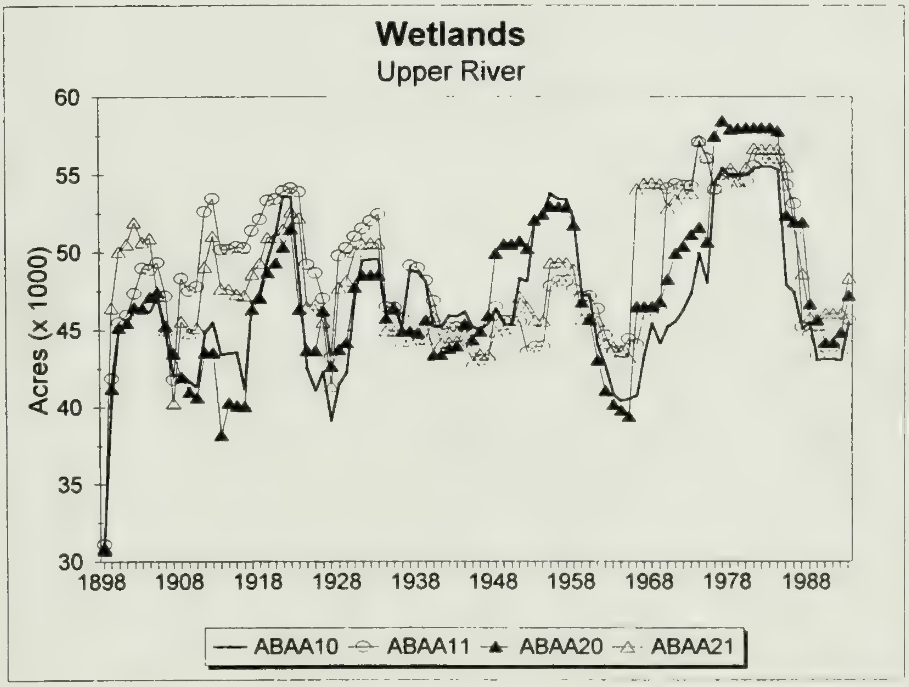

Figure 4-2. Average annual wetland acreage of the upper Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

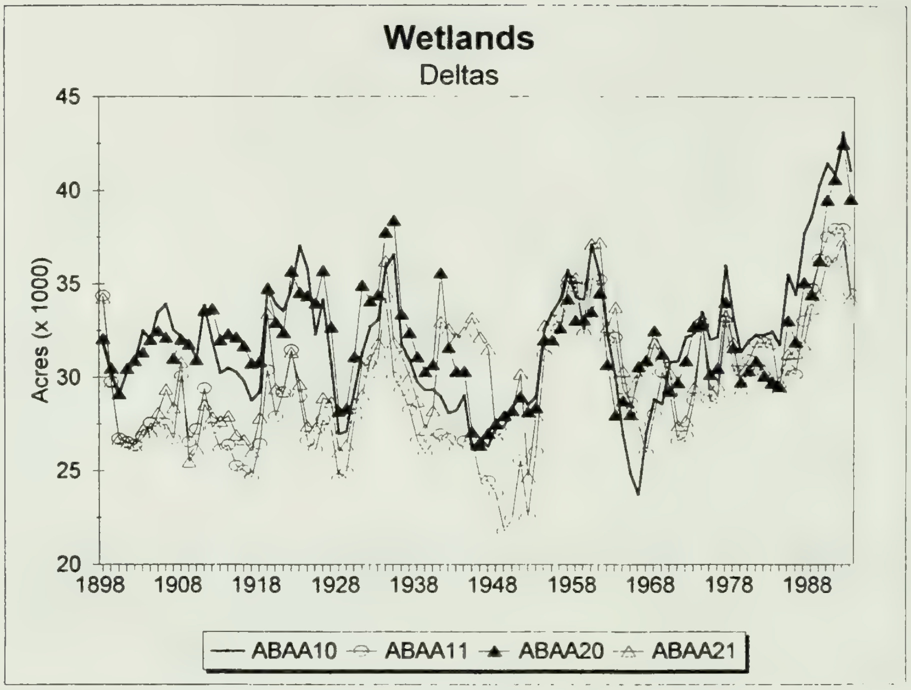

Figure 4-3. Average annual wetland acreage of mainstem lake deltas over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

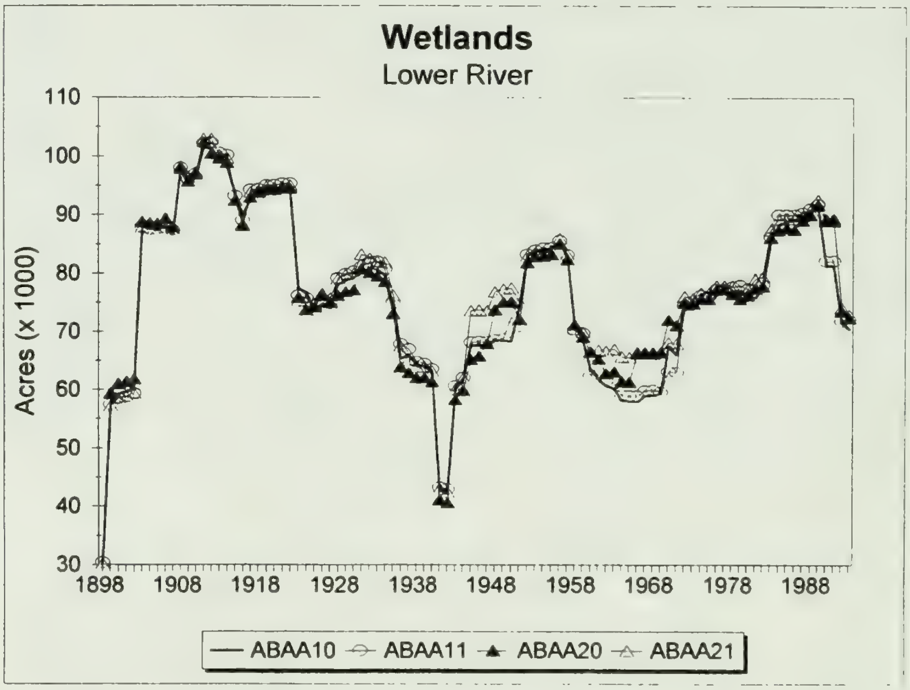

Figure 4-4. Average annual wetland acreage of lower Missouri River over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

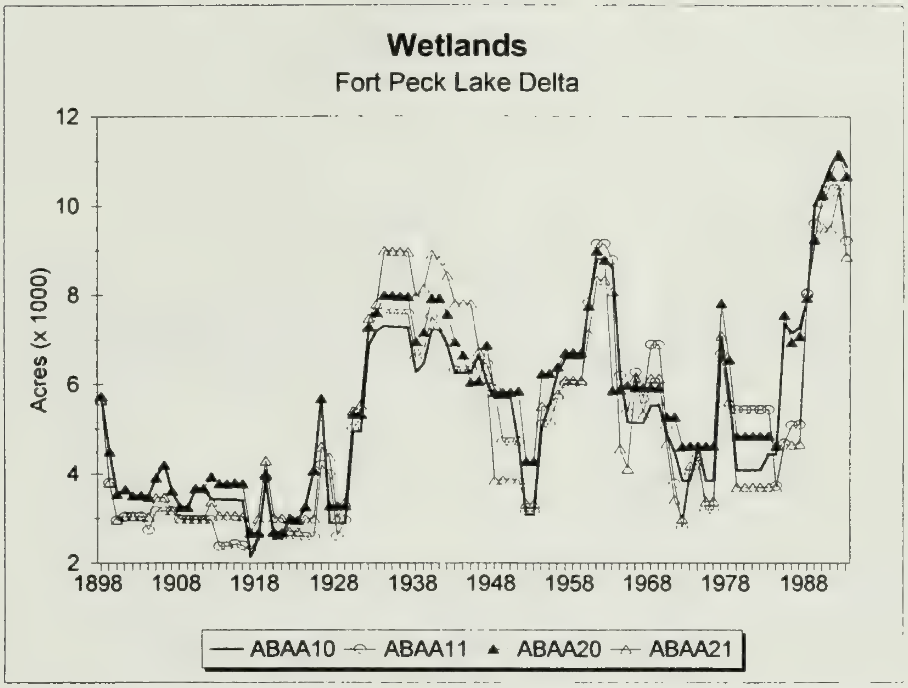

Figure 4-5. Average annual wetland acreage of Fort Peck Lake delta over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

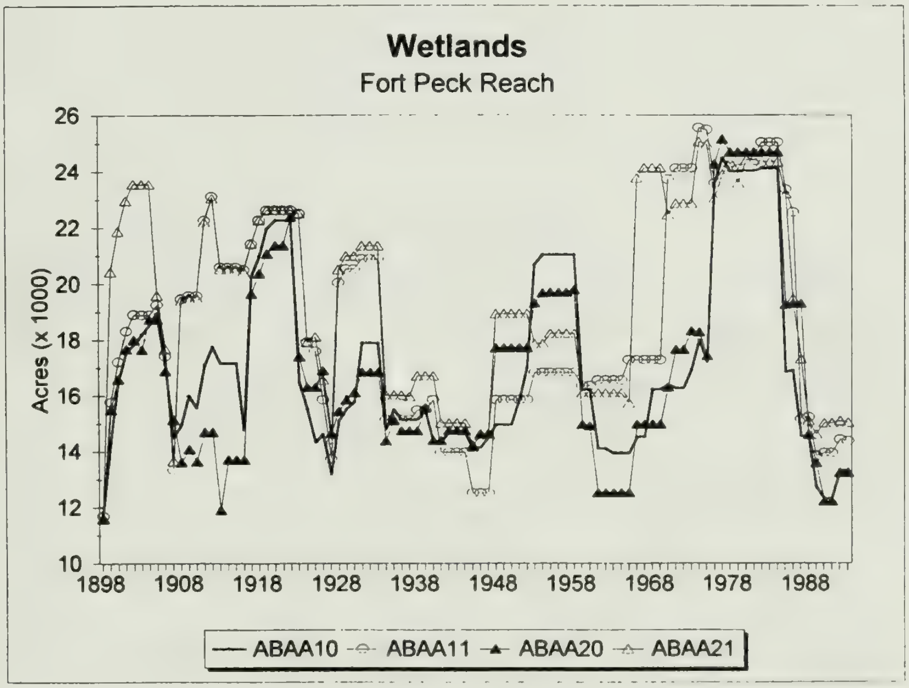

Figure 4-6. Average annual wetland acreage of Fort Peck reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

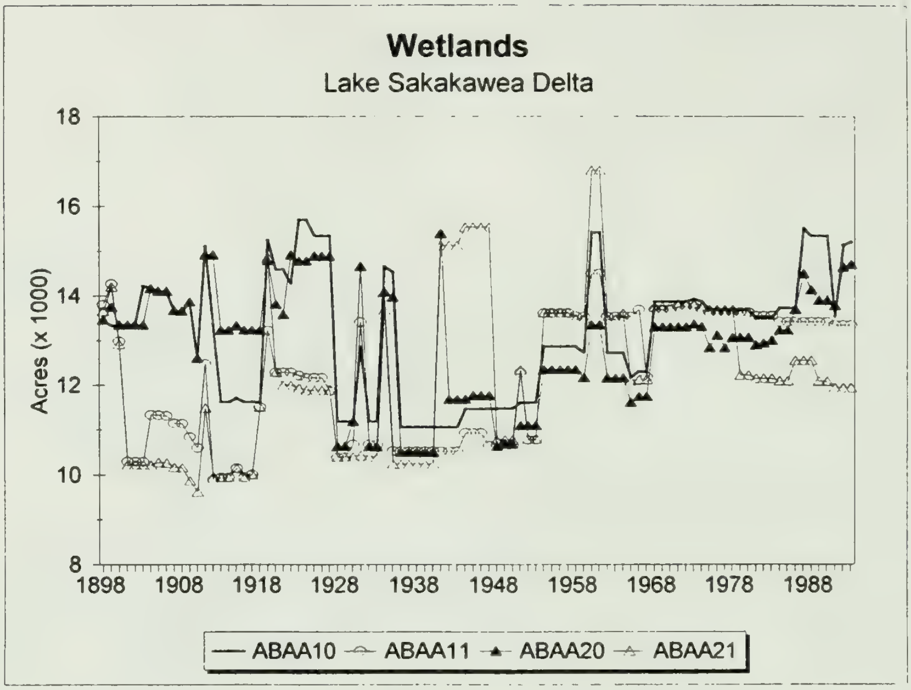

Figure 4-7. Average annual wetland acreage of Lake Sakakawea delta over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

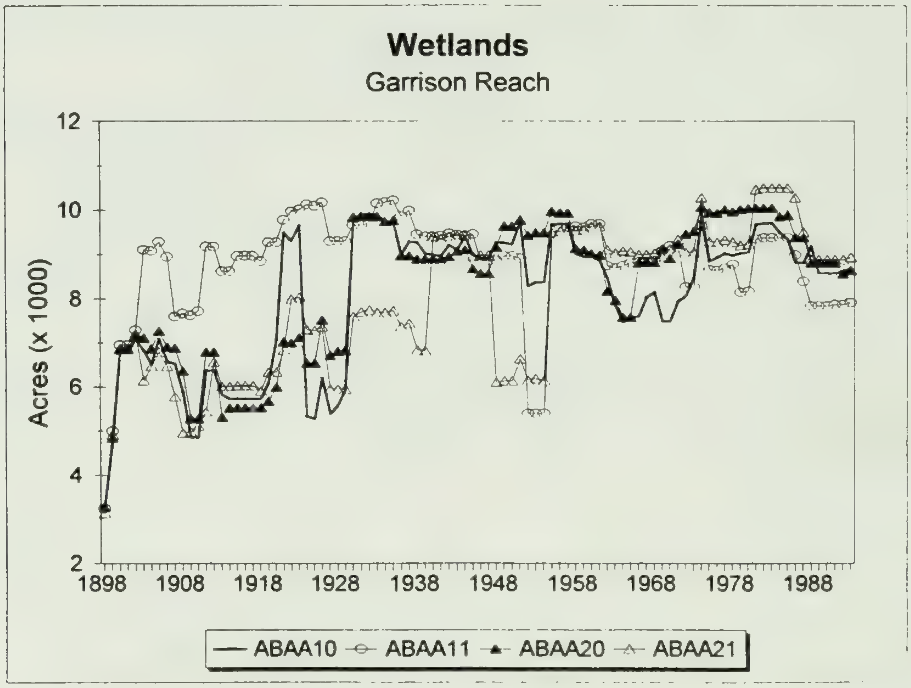

Figure 4-8. Average annual wetland acreage of Garrison reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

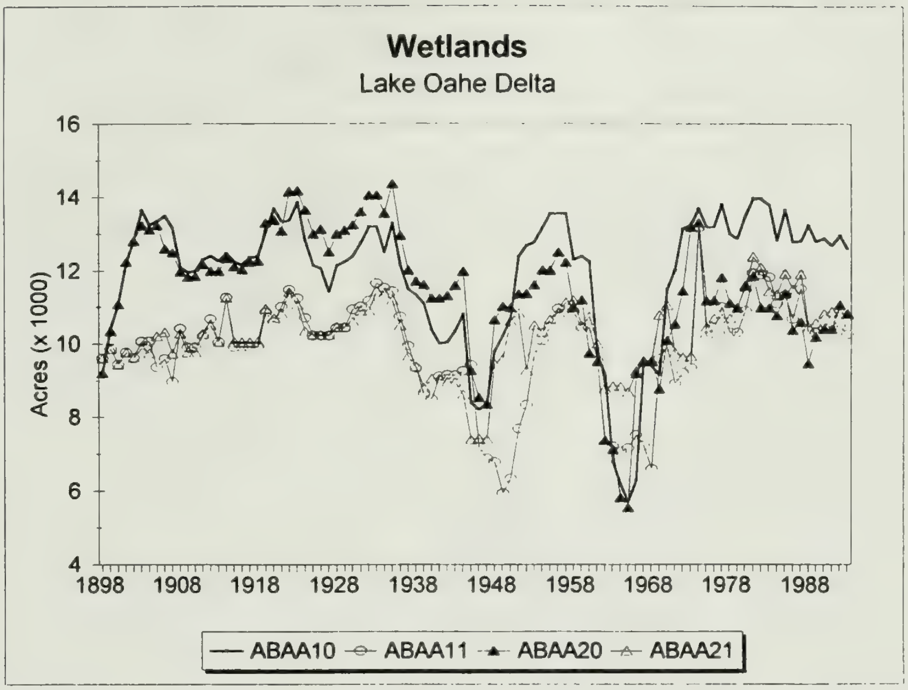

Figure 4-9. Average annual wetland acreage of Lake Oahe delta over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

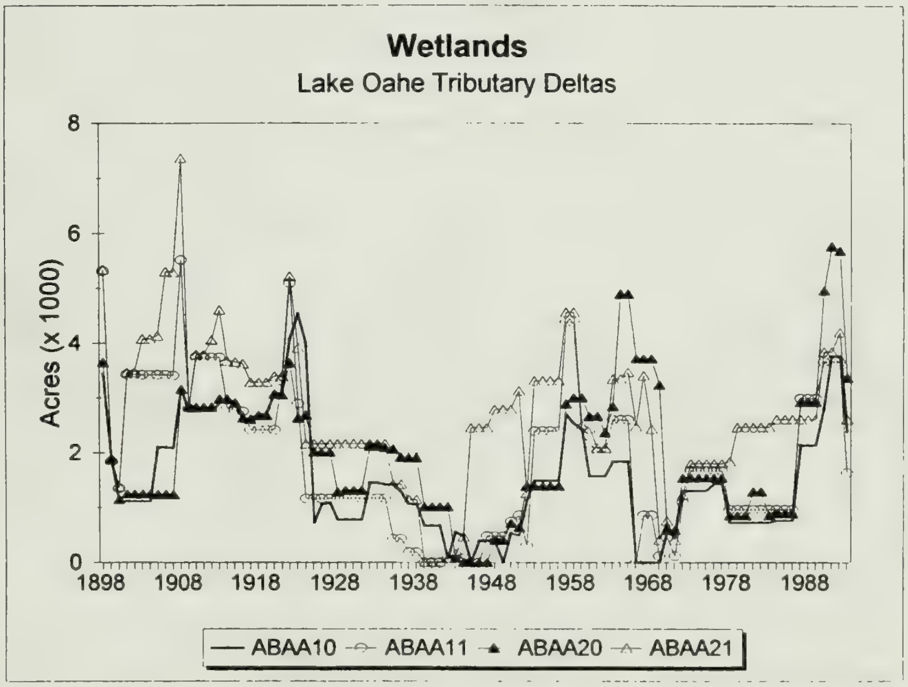

Figure 4-10. Average annual wetland acreage of Lake Oahe tributary deltas over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

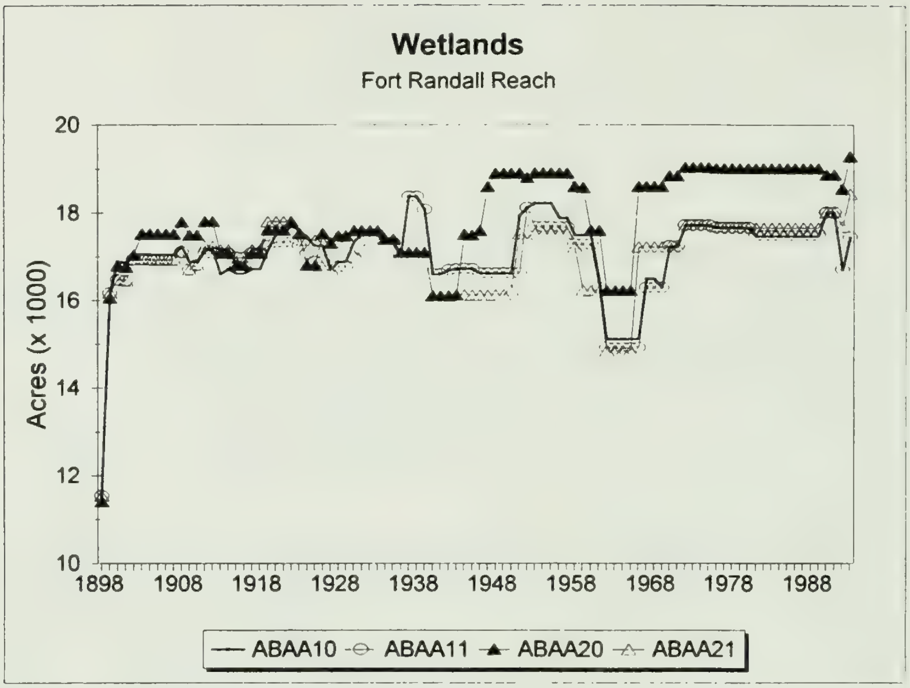

Figure 4-11. Average annual wetland acreage of Fort Randall reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

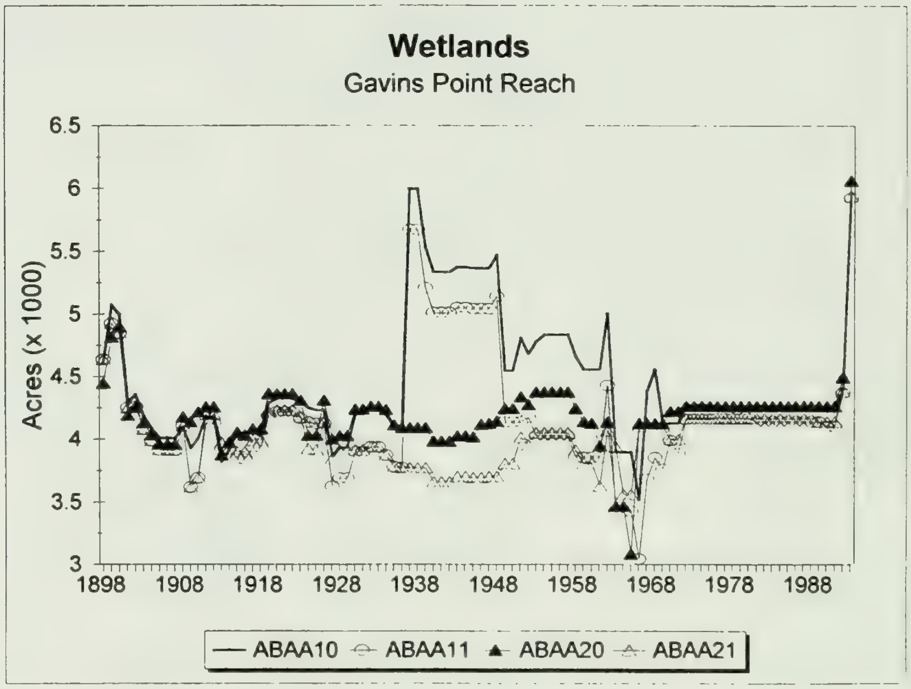

Figure 4-12. Average annual wetland acreage of Gavins Point reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

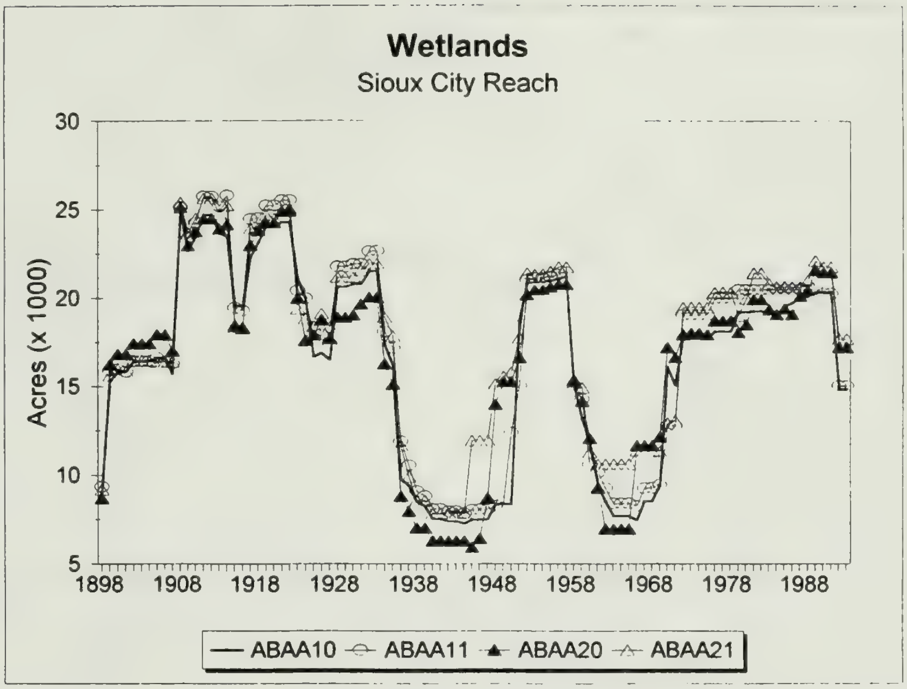

Figure 4-13. Average annual wetland acreage of Sioux City reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

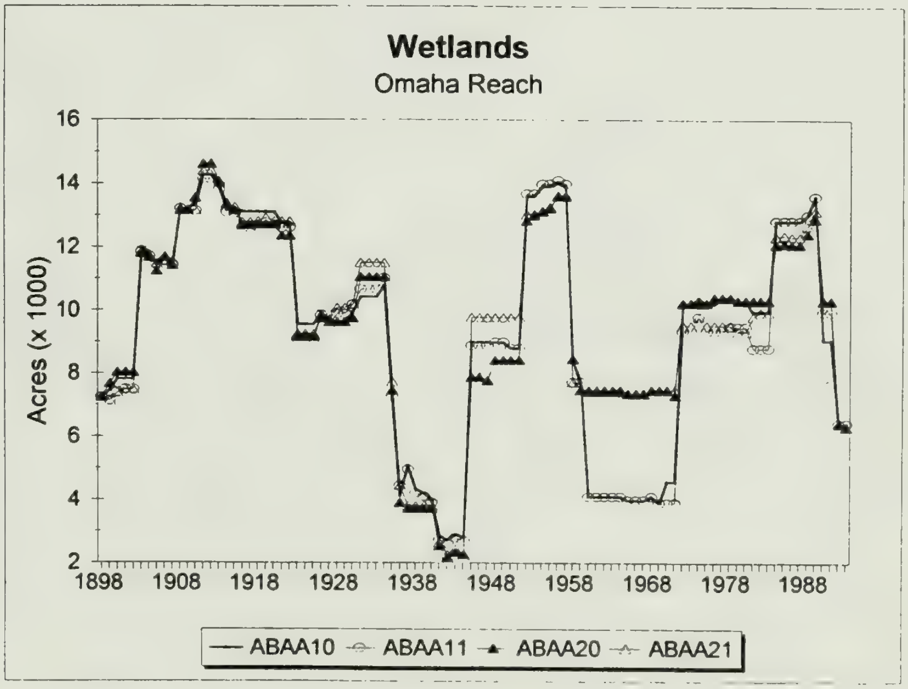

Figure 4-14. Average annual wetland acreage of Omaha reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

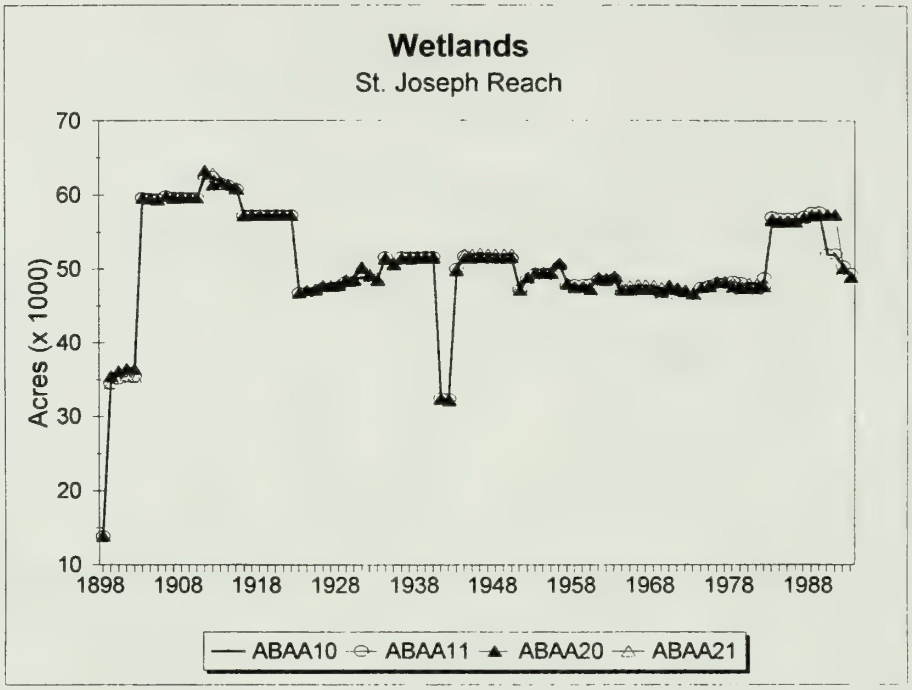

Figure 4-15. Average annual wetland acreage of St. Joseph reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

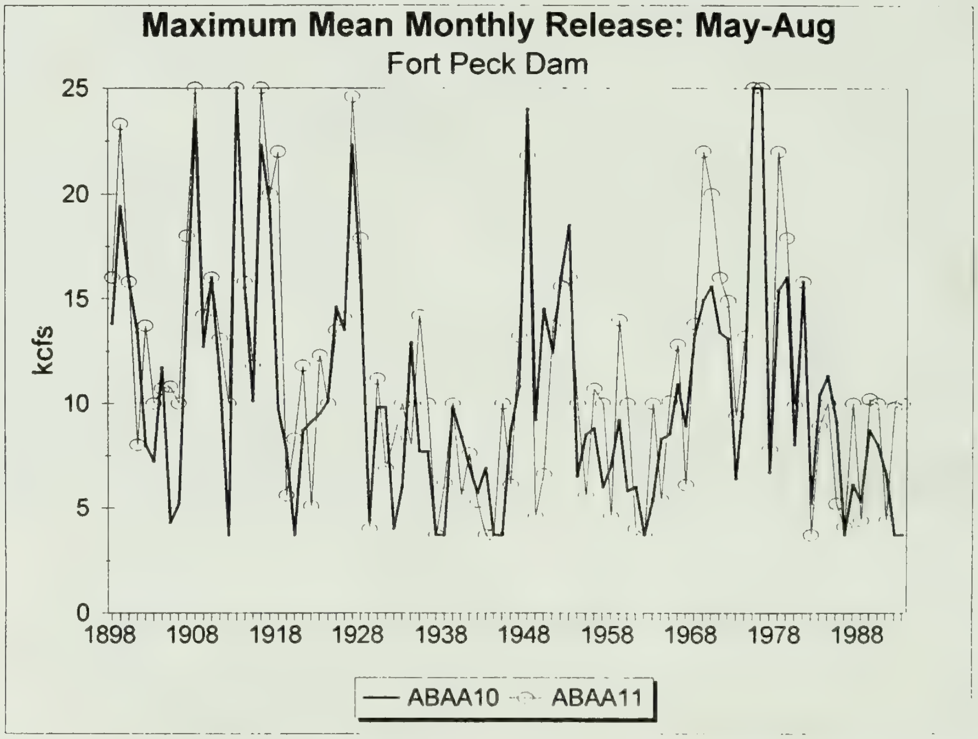

Figure 4-16. Maximum mean monthly release from Fort Peck Dam for May through August for alternatives ABAA10 and ABAA11 over the 96-year simulation period.

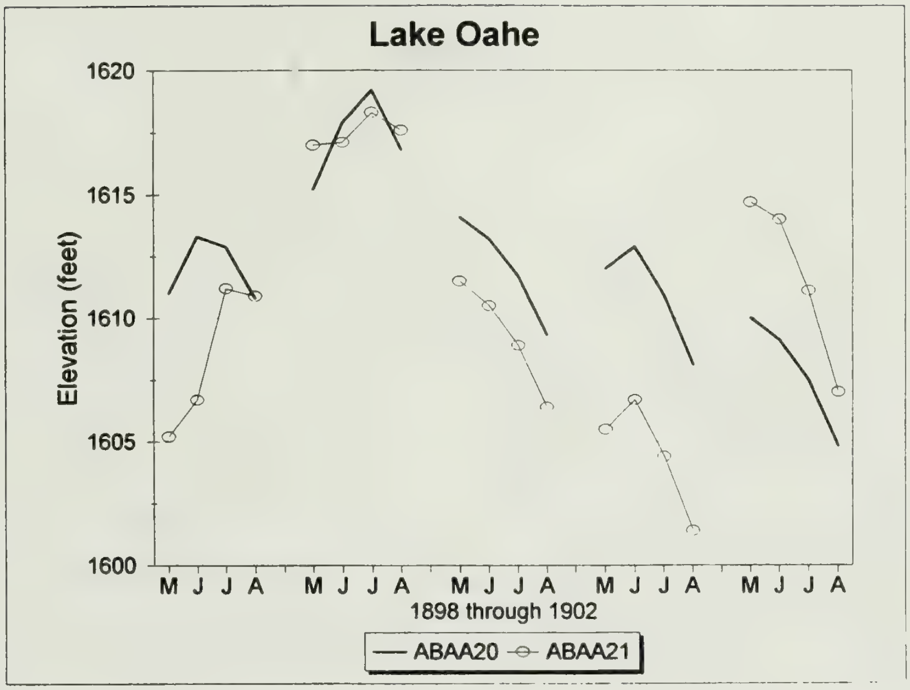

Figure 4-17. Comparison of May, June, July, and August lake levels at Lake Oahe for alternatives ABAA20 and ABAA21 from 1898 to 1903.

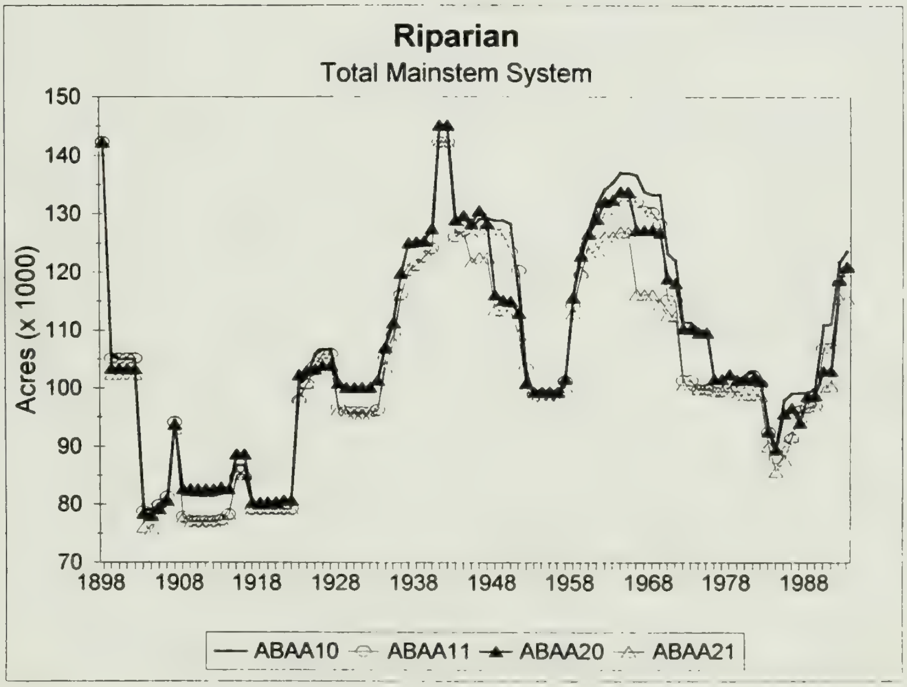

Figure 4-18. Average annual acreage of woody riparian vegetation in the entire Missouri River system over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

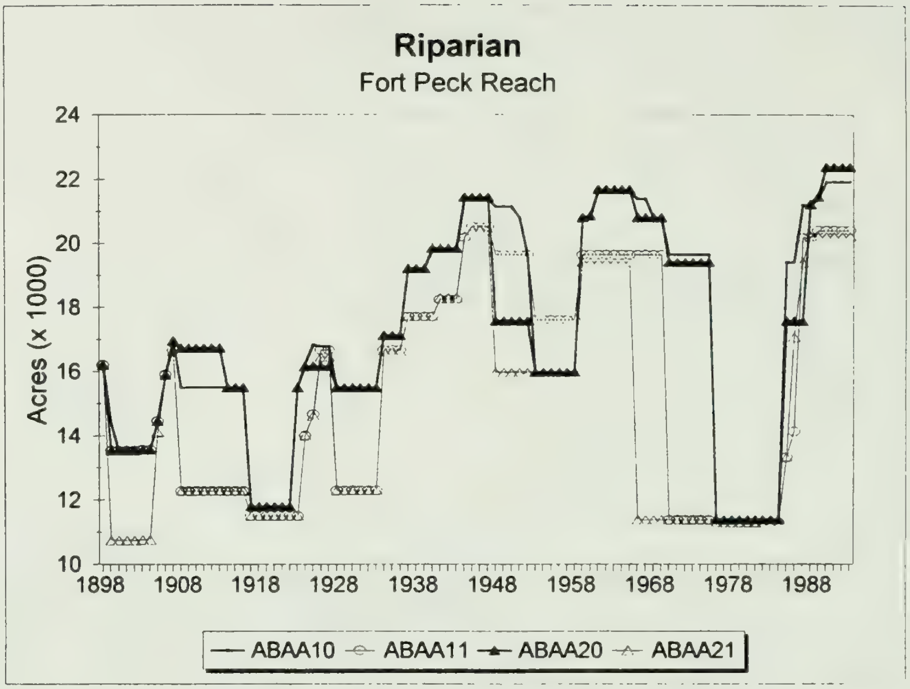

Figure 4-19. Average annual acreage of woody riparian vegetation in Fort Peck reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

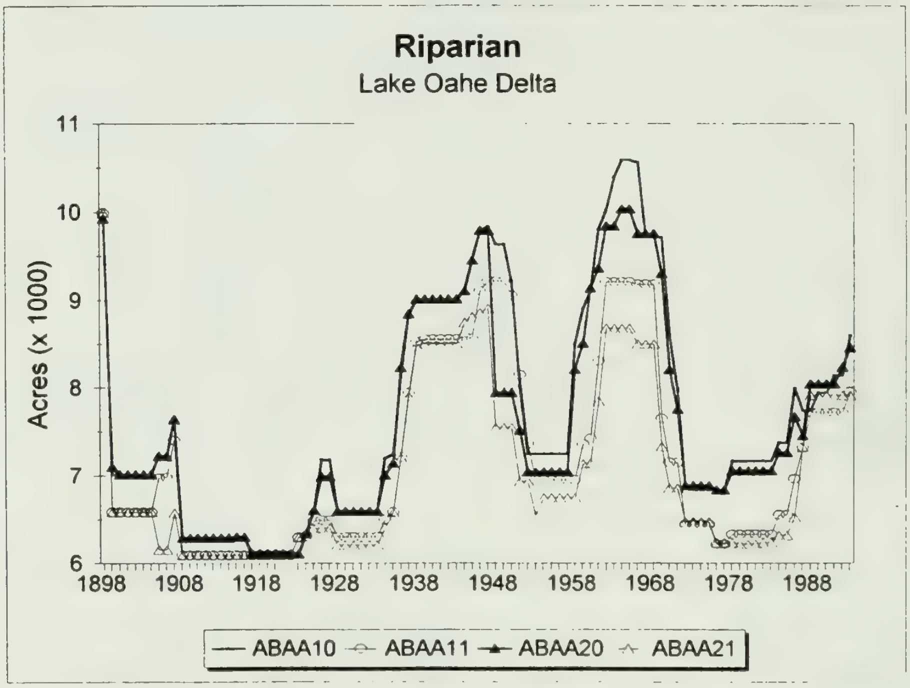

Figure 4-20. Average annual acreage of woody riparian vegetation in Lake Oahe delta over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

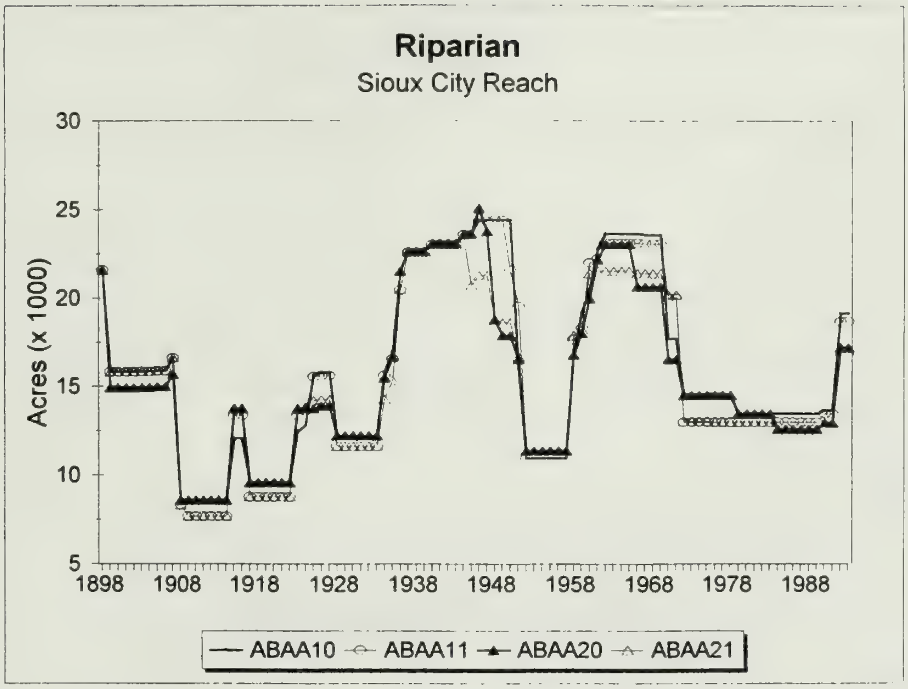

Figure 4-21. Average annual acreage of woody riparian vegetation in Sioux City reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

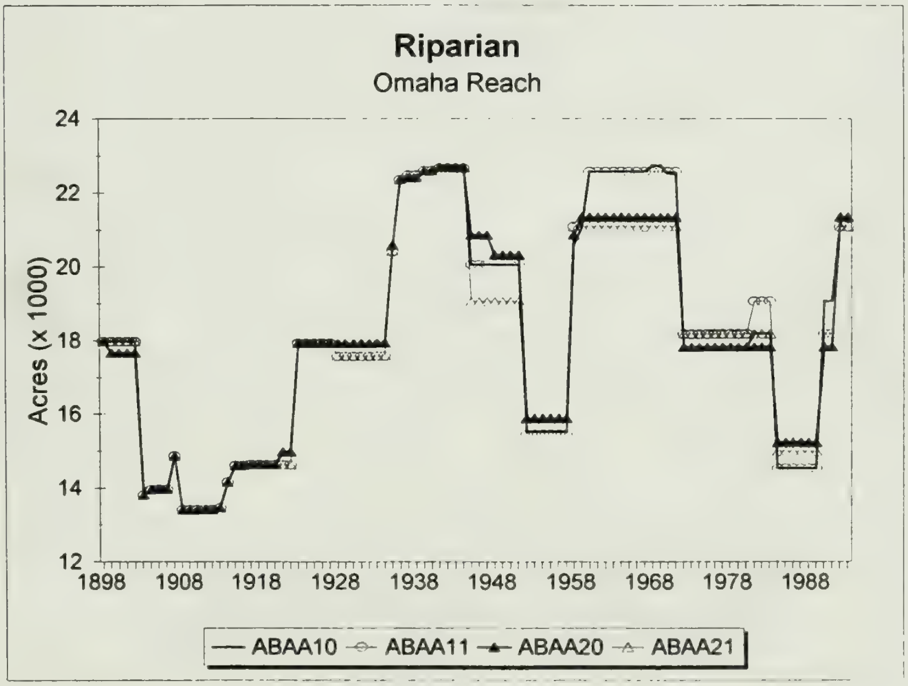

Figure 4-22. Average annual acreage of woody riparian vegetation in Omaha reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

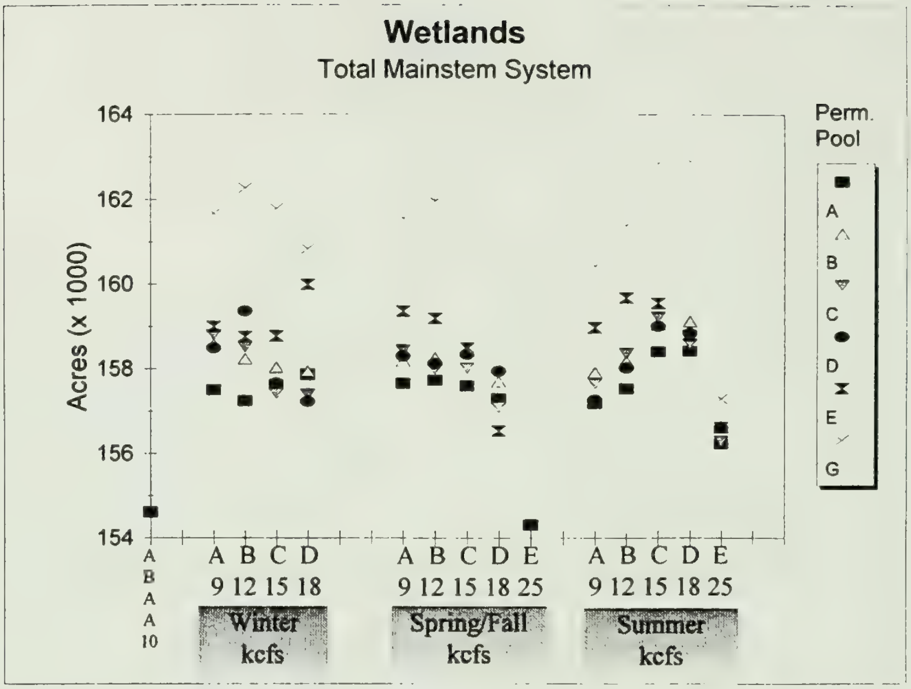

Figure 4-23. Annual average wetland acreage for the total Mainstem System over the 96-year simulation period for the Basic Set of alternatives by nonnavigation service level.

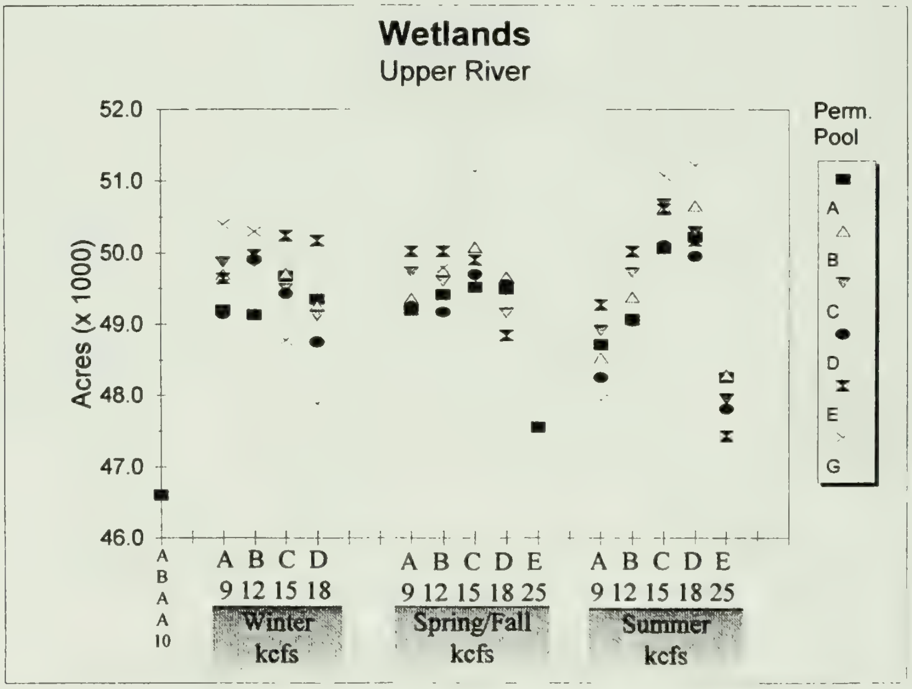

Figure 4-24. Annual average wetland acreage over the 96-year simulation period in upper river sections of the Mainstem System for the Basic Set of alternatives by nonnavigation service level.

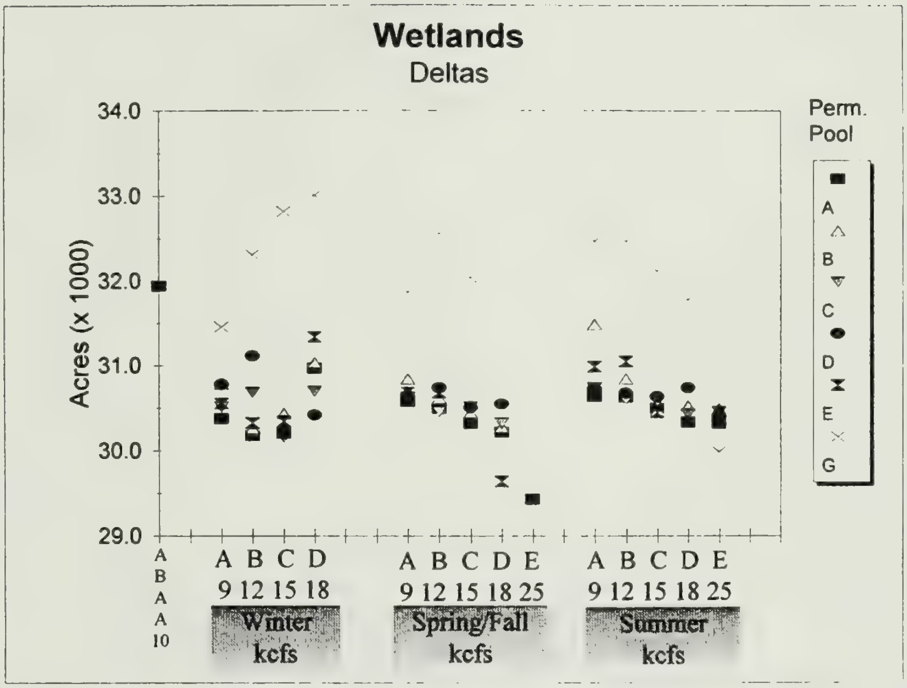

Figure 4-25. Annual average wetland acreage over the 96-year simulation period in the mainstem lake deltas for the Basic Set of alternatives by nonnavigation service level.

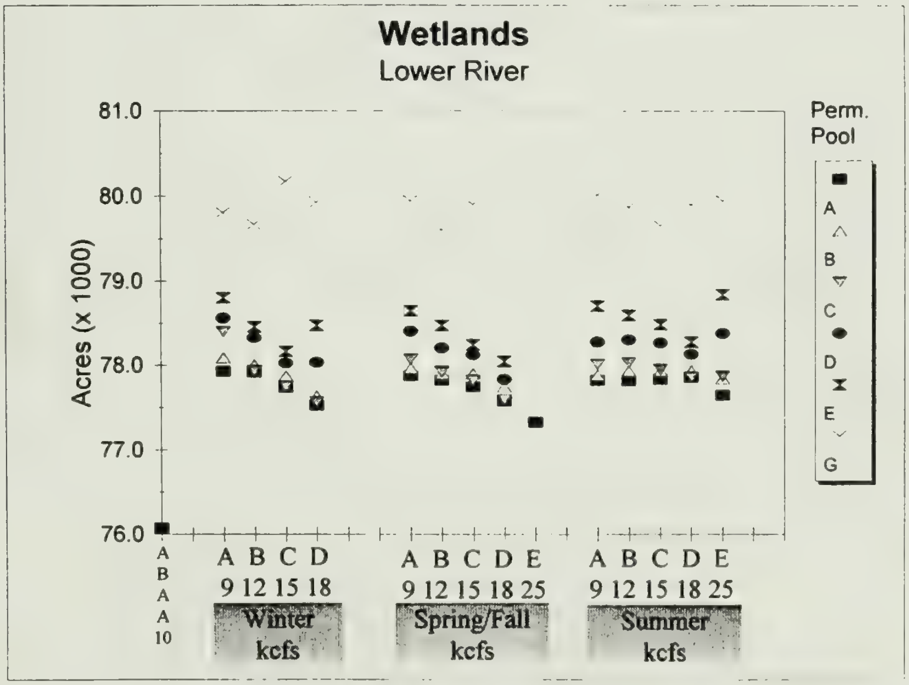

Figure 4-26. Annual average wetland acreage over the 96-year simulation period in lower river sections of the Mainstem System for the Basic Set of alternatives by nonnavigation service level.

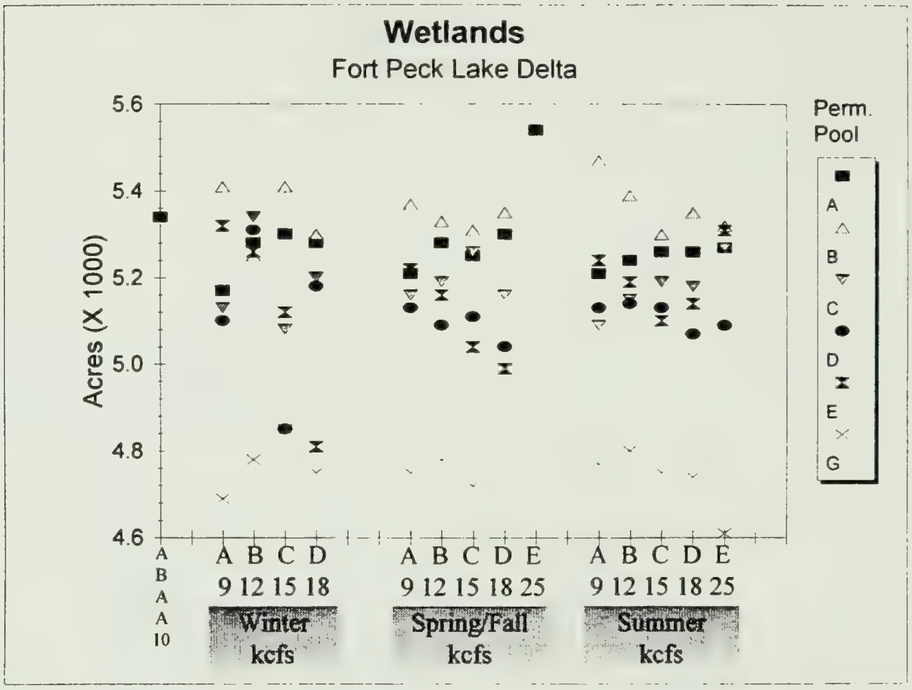

Figure 4-27. Annual average wetland acreage over the 96-year simulation period in Fort Peck Lake delta for the Basic Set of alternatives by nonnavigation service level.

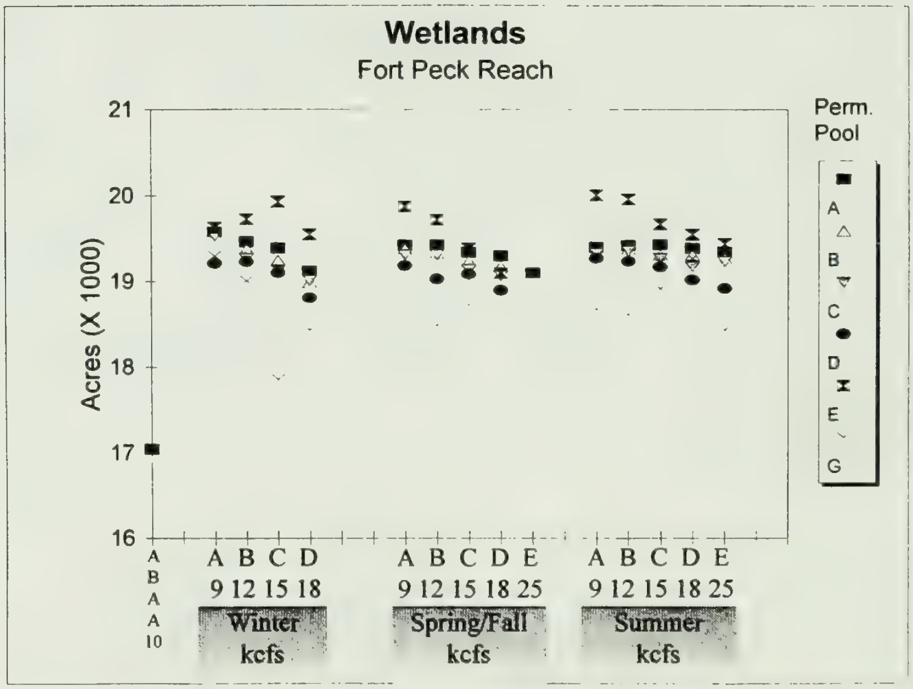

Figure 4-28. Annual average wetland acreage over the 96-year simulation period in Fort Peck reach for the Basic Set of alternatives by nonnavigation service level.

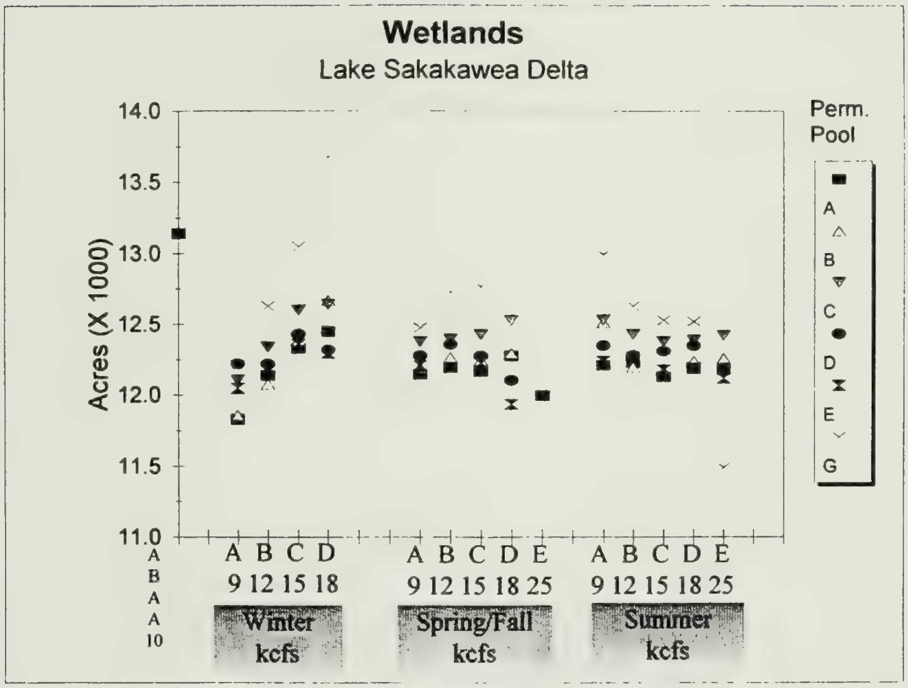

Figure 4-29. Annual average wetland acreage over the 96-year simulation period in Lake Sakakawea delta for the Basic Set of alternatives by nonnavigation service level.

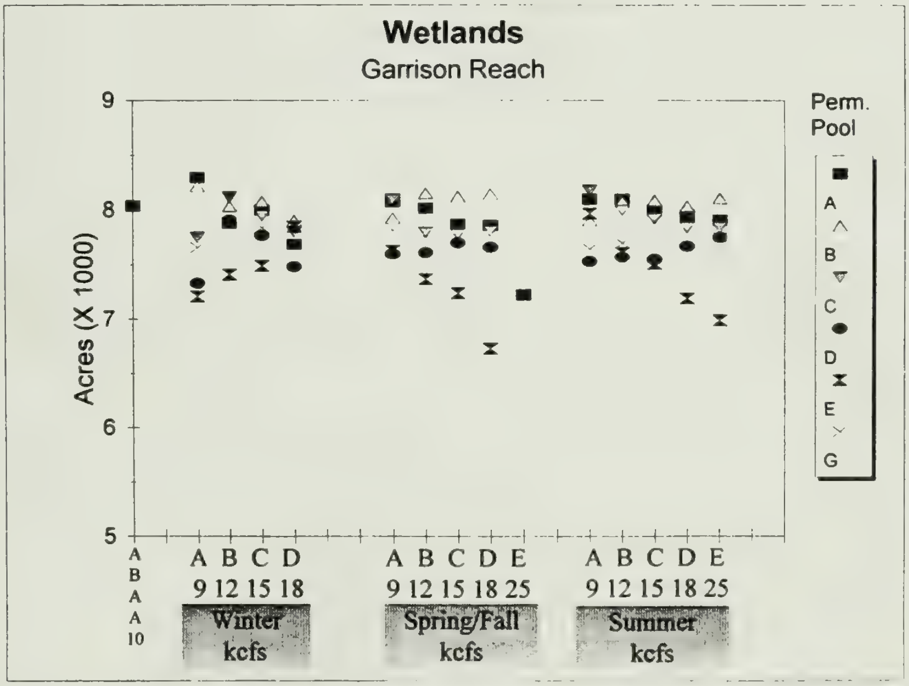

Figure 4-30. Annual average wetland acreage over the 96-year simulation period in Garrison reach for the Basic Set of alternatives by nonnavigation service level.

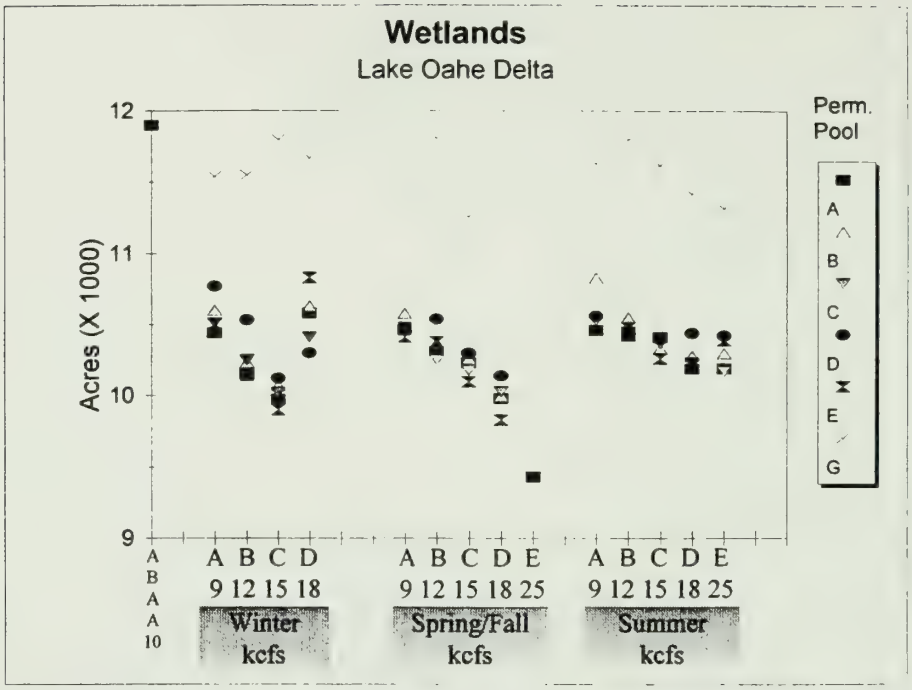

Figure 4-31. Annual average wetland acreage over the 96-year simulation period in Lake Oahe delta for the Basic Set of alternatives by nonnavigation service level.

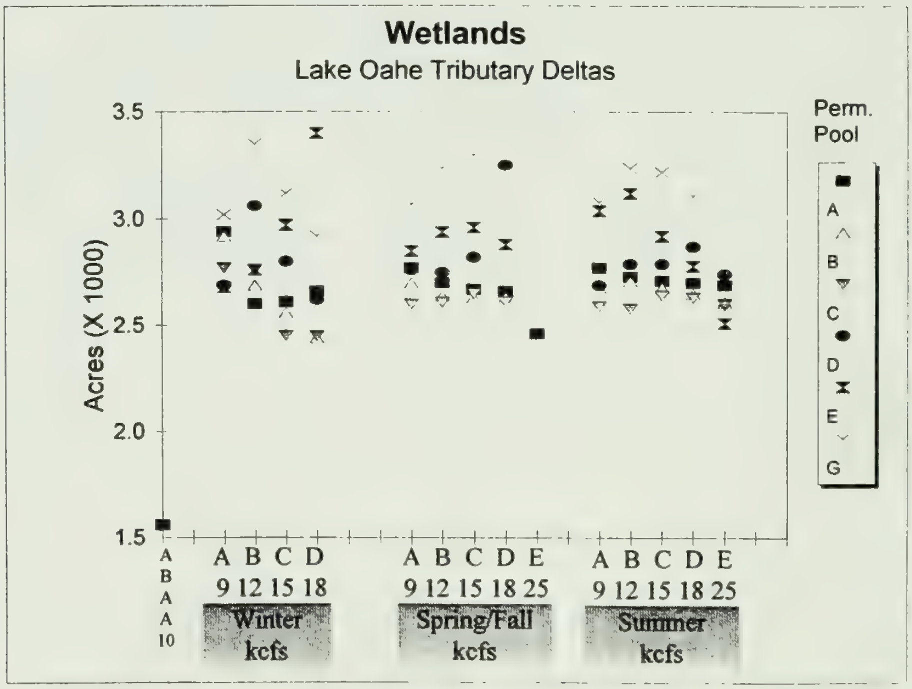

Figure 4-32. Annual average wetland acreage over the 96-year simulation period in Lake Oahe tributary deltas for the Basic Set of alternatives by nonnavigation service level.

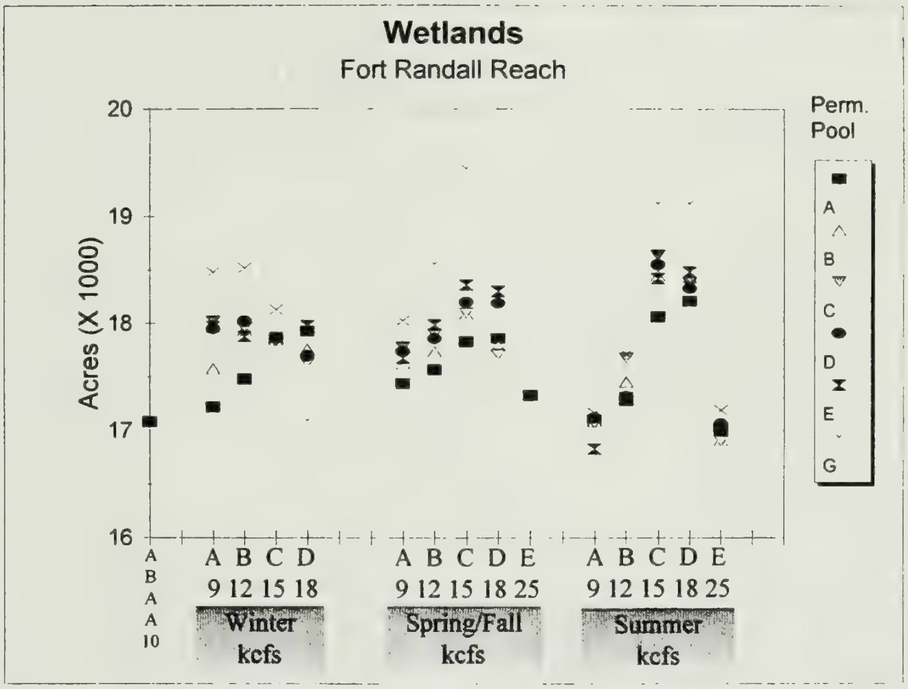

Figure 4-33. Annual average wetland acreage over the 96-year simulation period in Fort Randall reach for the Basic Set of alternatives by nonnavigation service level.

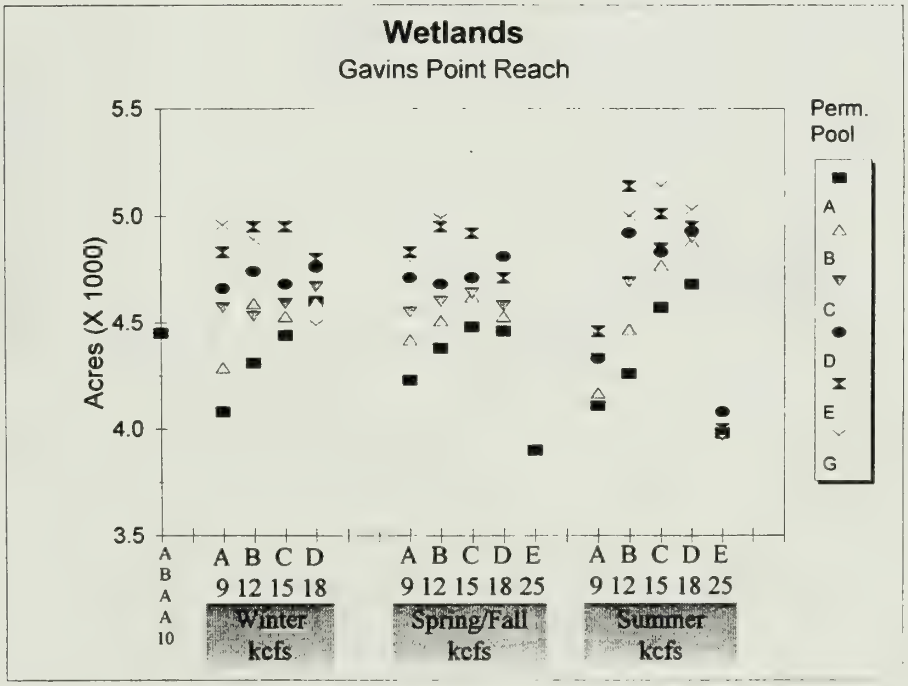

Figure 4-34. Annual average wetland acreage over the 96-year simulation period in Gavins Point reach for the Basic Set of alternatives by nonnavigation service level.

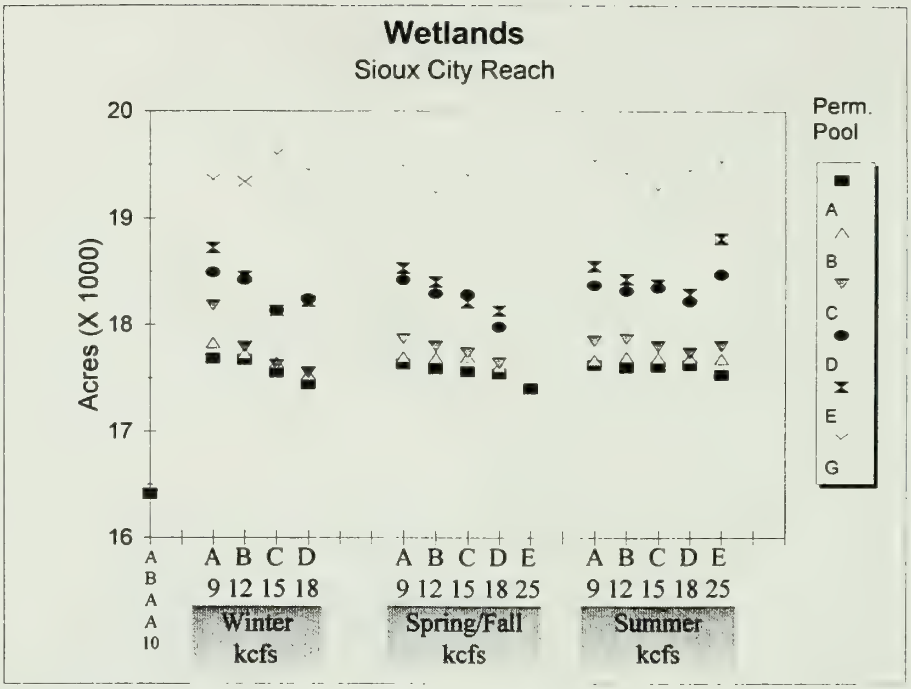

Figure 4-35. Annual average wetland acreage over the 96-year simulation period in Sioux City reach for the Basic Set of alternatives by nonnavigation service level.

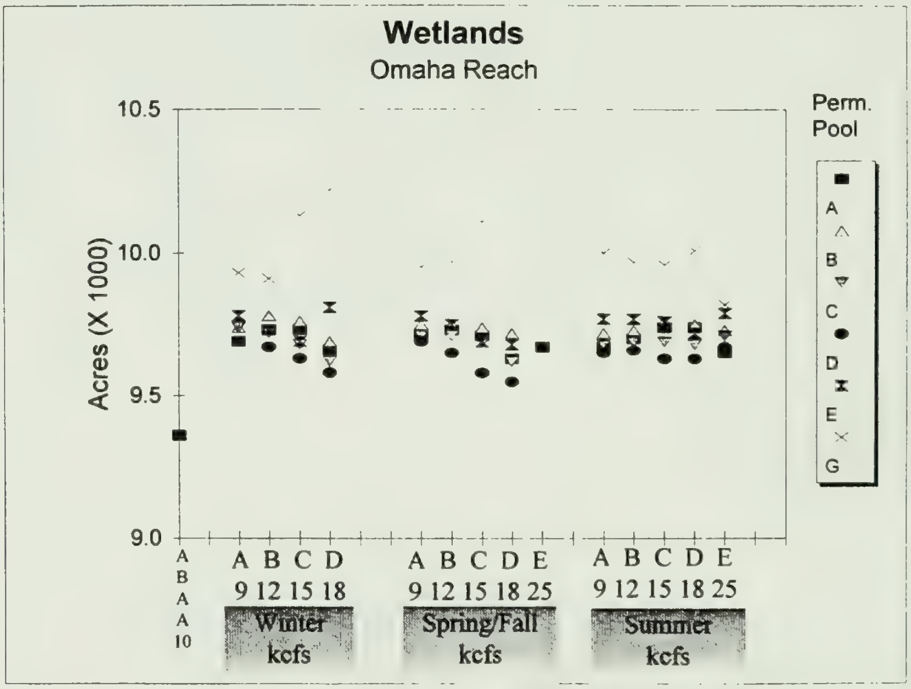

Figure 4-36. Annual average wetland acreage over the 96-year simulation period in Omaha reach for the Basic Set of alternatives by nonnavigation service level.

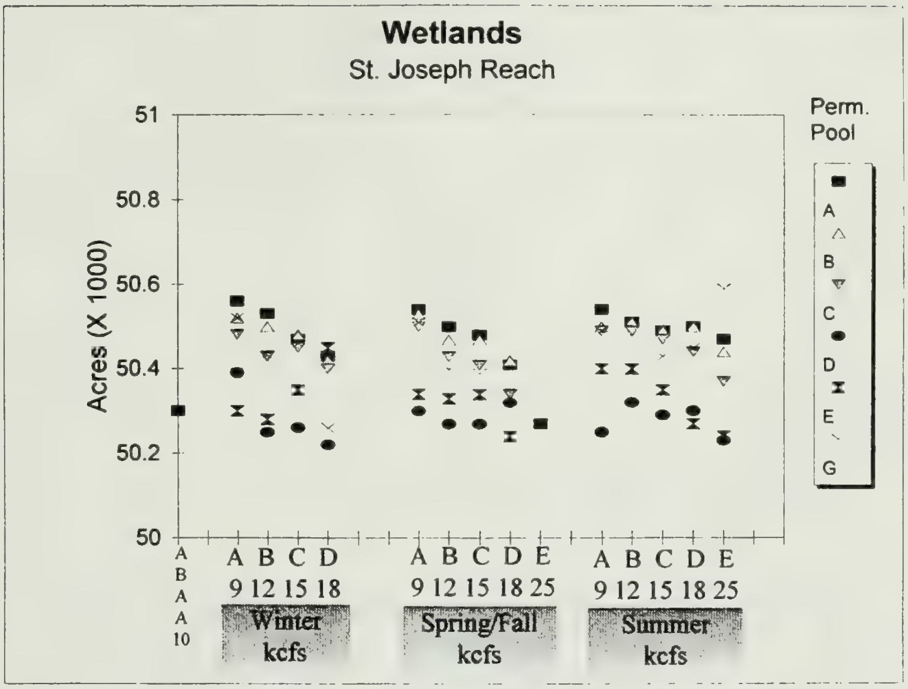

Figure 4-37. Annual average wetland acreage over the 96-year simulation period in St. Joseph reach for the Basic Set of alternatives by nonnavigation service level.

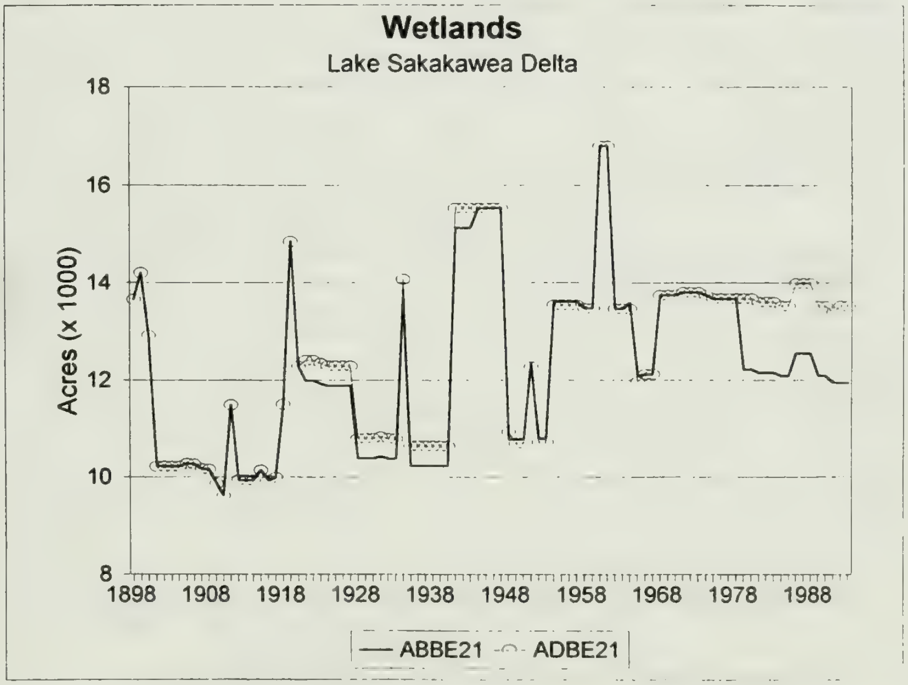

Figure 4-38. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for alternatives ADBE21 and ABBE21.

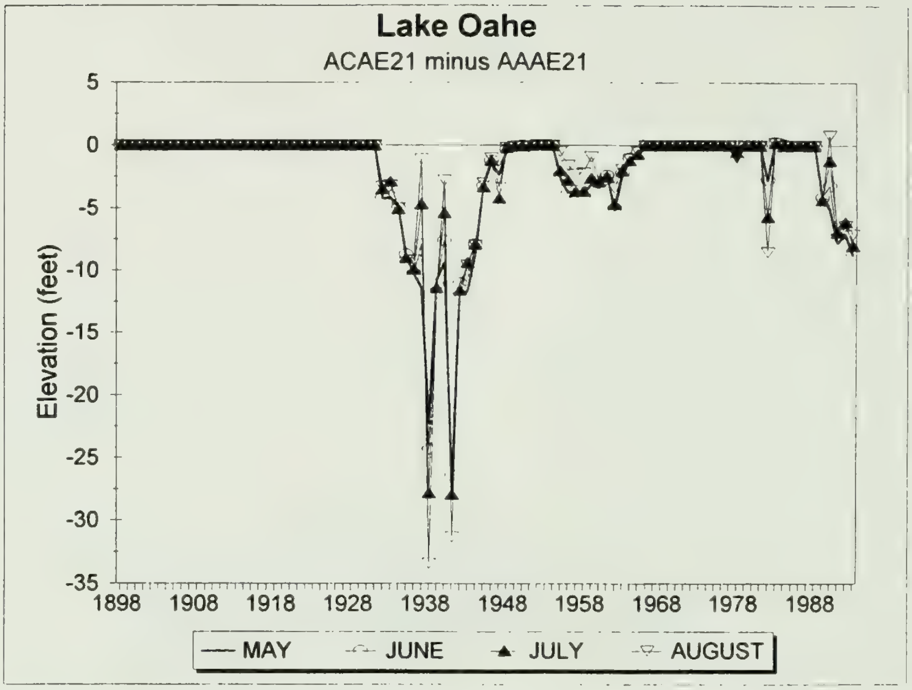

Figure 4-39. Difference in average May, June, July, and August water levels in Lake Oahe resulting between alternatives ACAE21 and AAAE21.

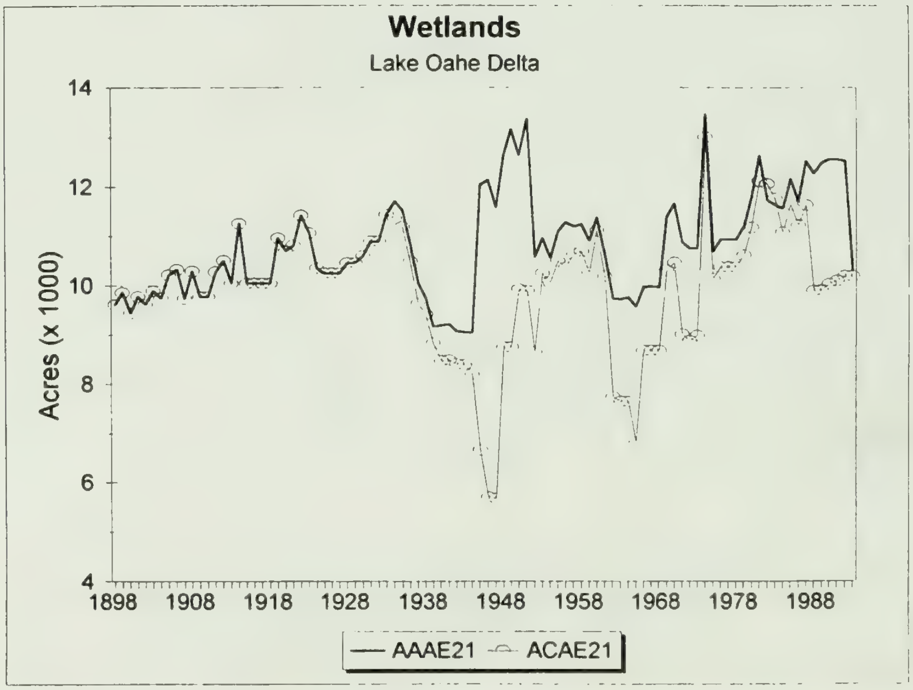

Figure 4-40. Difference in average annual wetland acreage in Lake Oahe delta between alternatives ACAE21 and AAAE21.

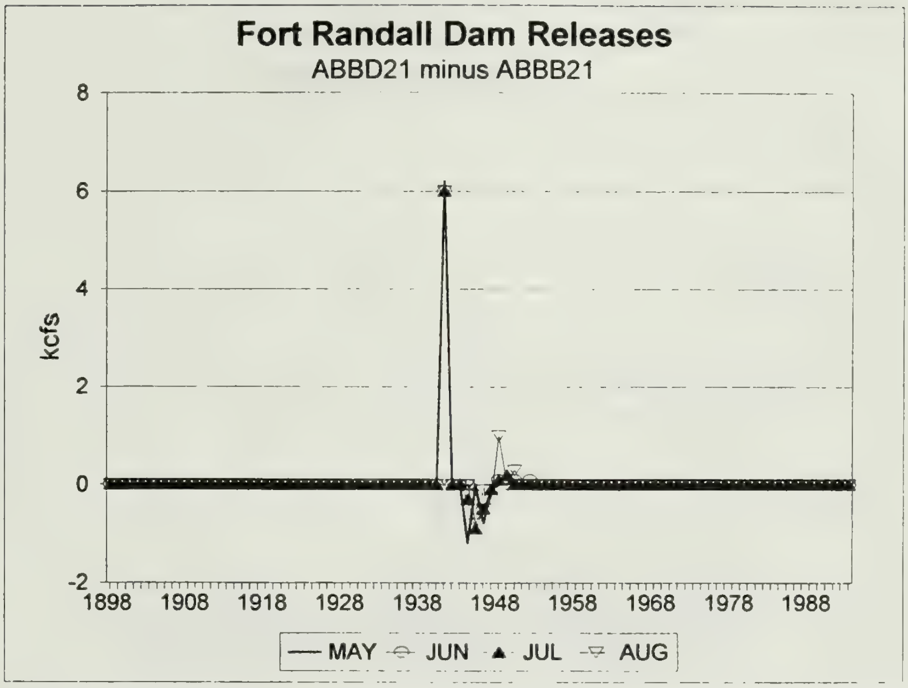

Figure 4-41. Difference in average May, June, July, and August water releases at Fort Randall Dam between alternatives ABBD21 and ABBB21.

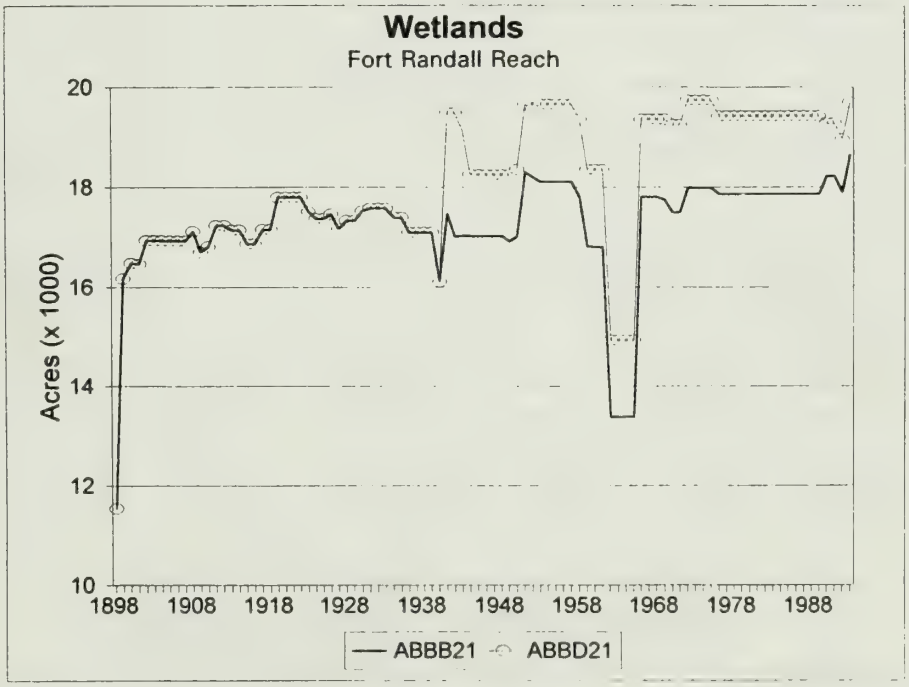

Figure 4-42. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for alternatives ABBD21 and ABBB21.

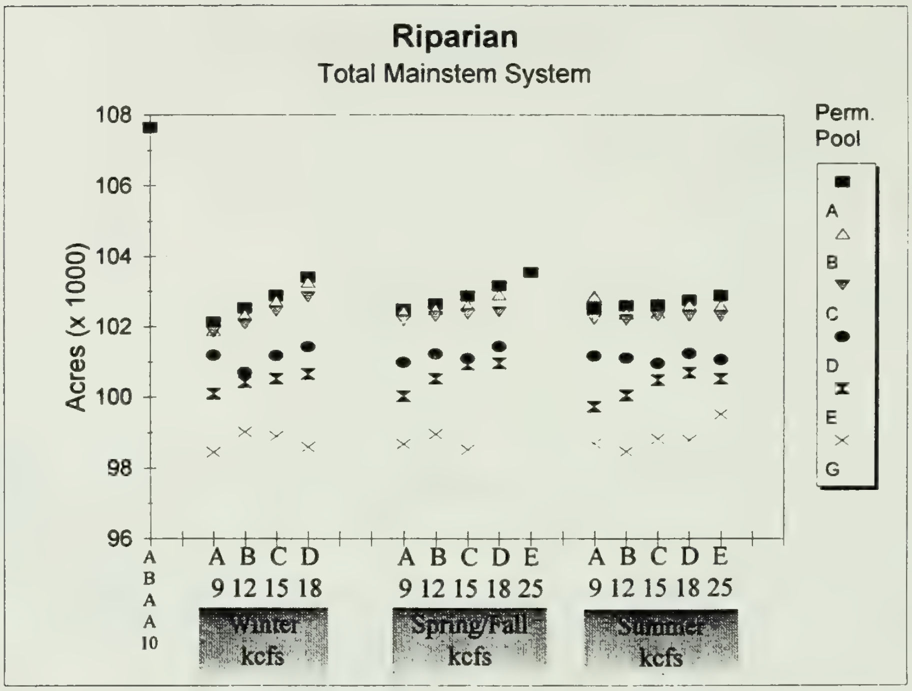

Figure 4-43. Average annual acreage of woody riparian vegetation in the Mainstem System for the Basic Set of alternatives by nonnavigation service level.

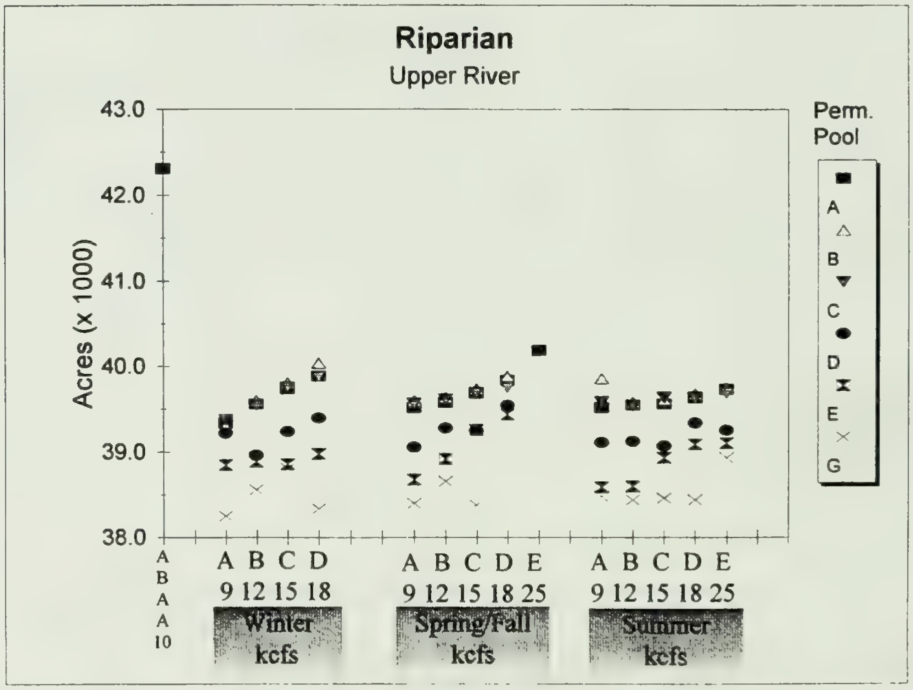

Figure 4-44. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System for the Basic Set of alternatives by nonnavigation service level.

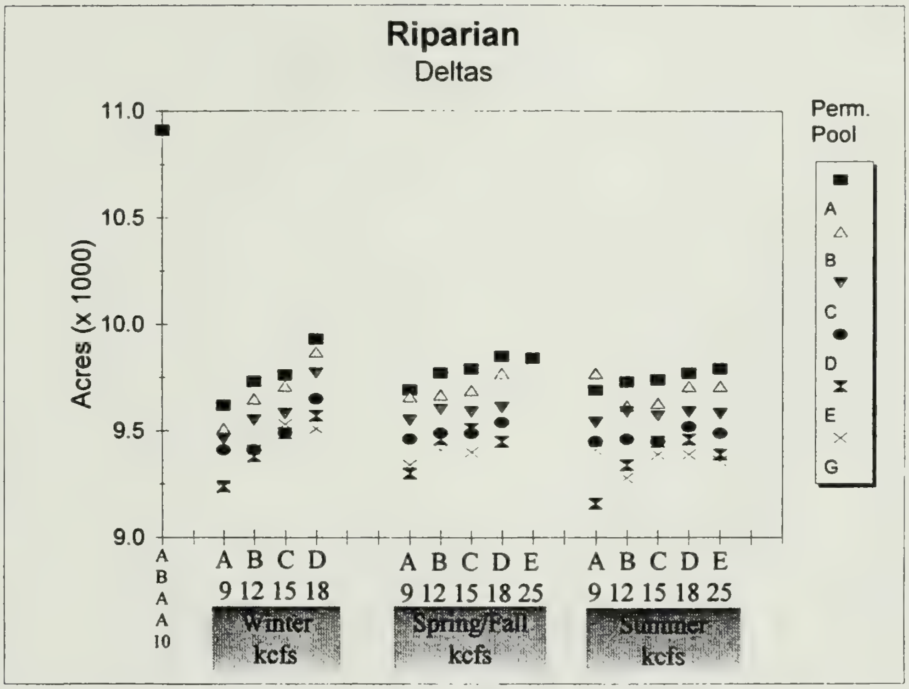

Figure 4-45. Average annual acreage of woody riparian vegetation in mainstem lake deltas for the Basic Set of alternatives by nonnavigation service level.

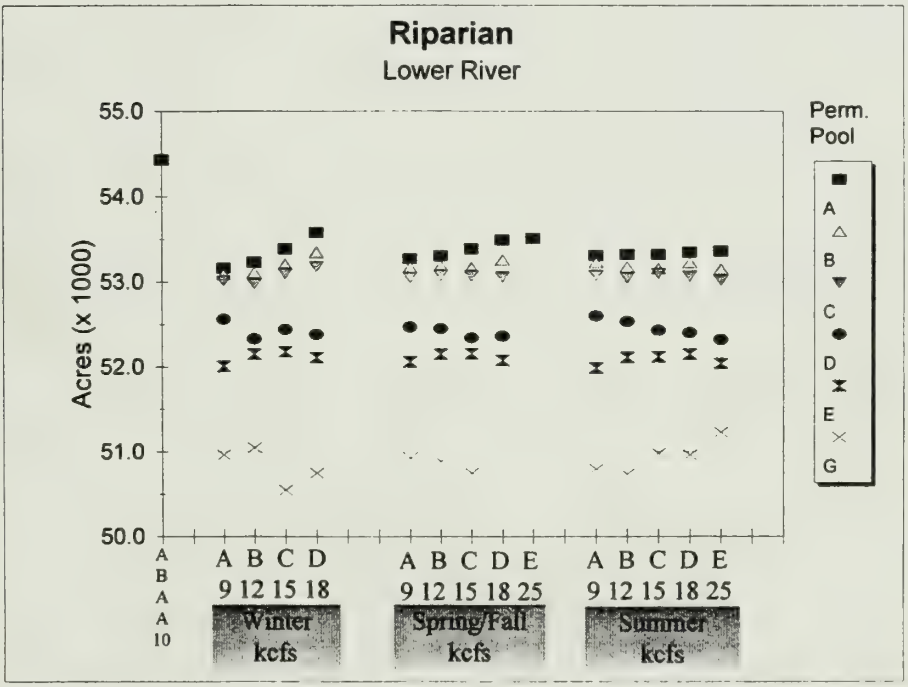

Figure 4-46. Average annual acreage of woody riparian vegetation in lower river sections of the Mainstem System for the Basic Set of alternatives by nonnavigation service level.

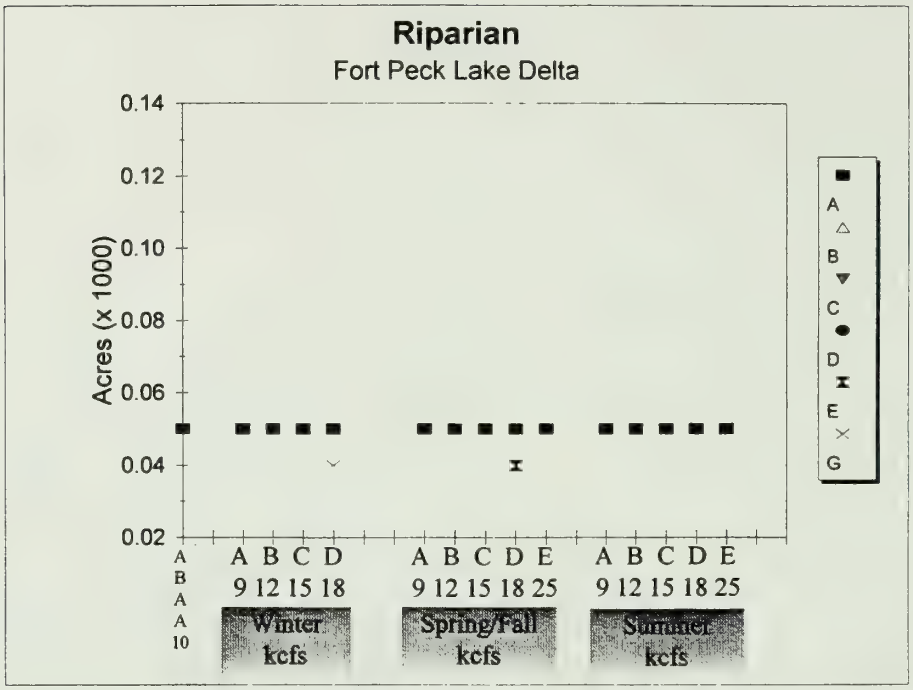

Figure 4-47. Average annual acreage of woody riparian vegetation in Fort Peck Lake delta for the Basic Set of alternatives by nonnavigation service level.

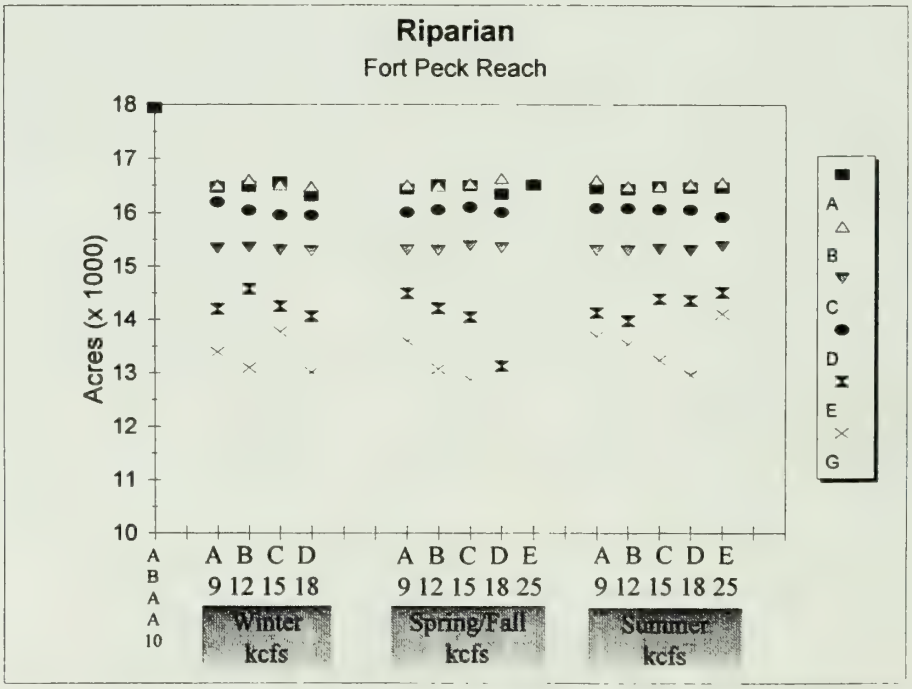

Figure 4-48. Average annual acreage of woody riparian vegetation in Fort Peck reach for the Basic Set of alternatives by nonnavigation service level.

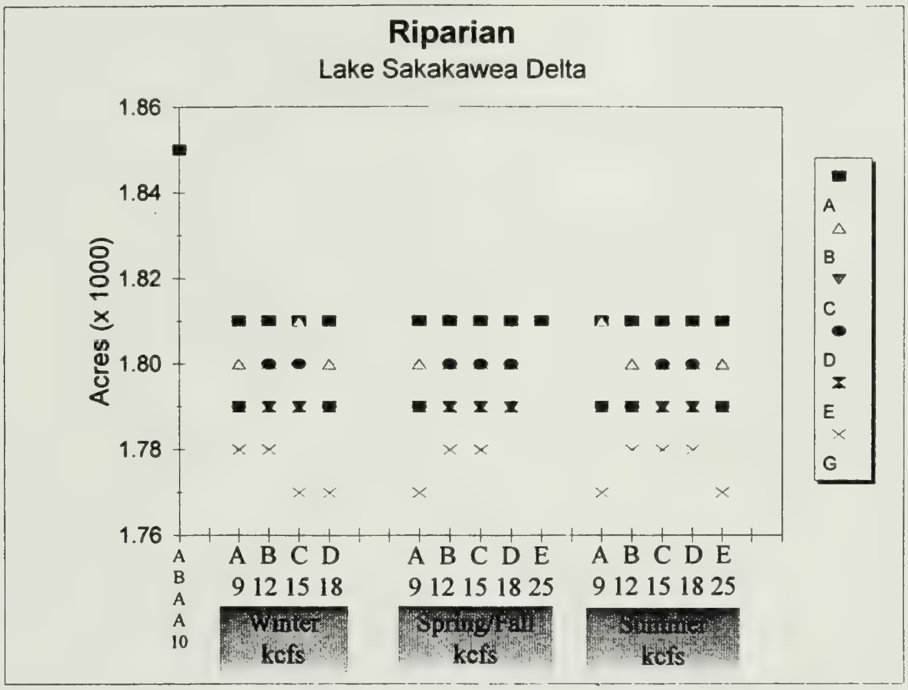

Figure 4-49. Average annual acreage of woody riparian vegetation in Lake Sakakawea delta for the Basic Set of alternatives by nonnavigation service level.

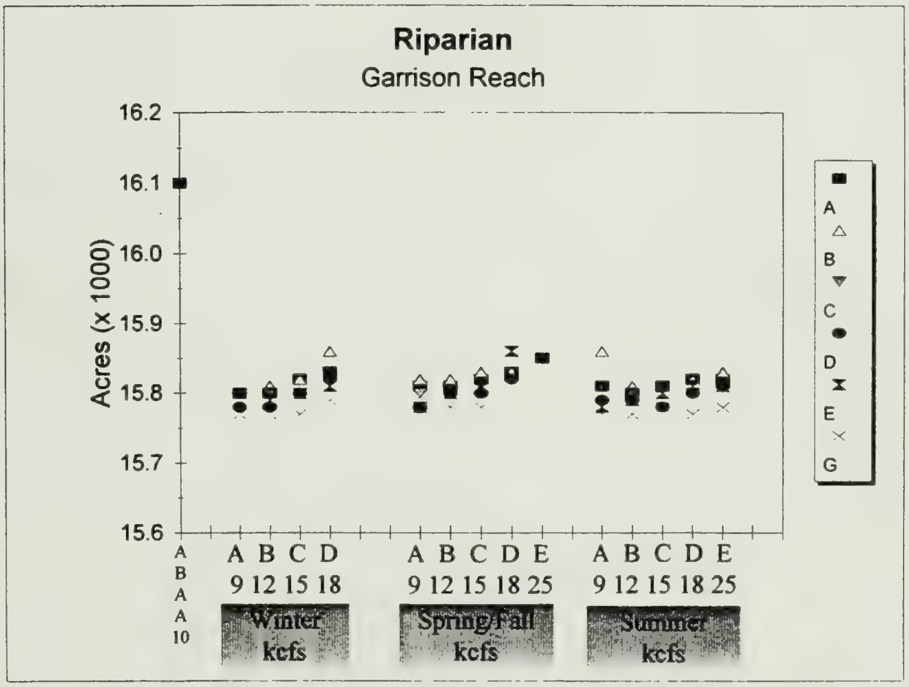

Figure 4-50. Average annual acreage of woody riparian vegetation in Garrison reach for the Basic Set of alternatives by nonnavigation service level.

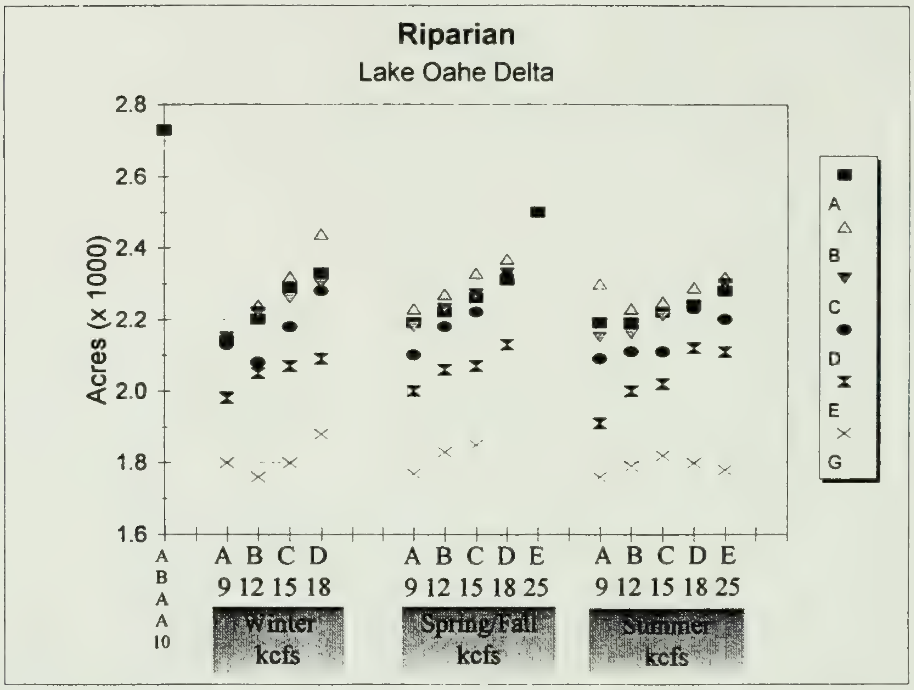

Figure 4-51. Average annual acreage of woody riparian vegetation in Lake Oahe delta for the Basic Set of alternatives by nonnavigation service level.

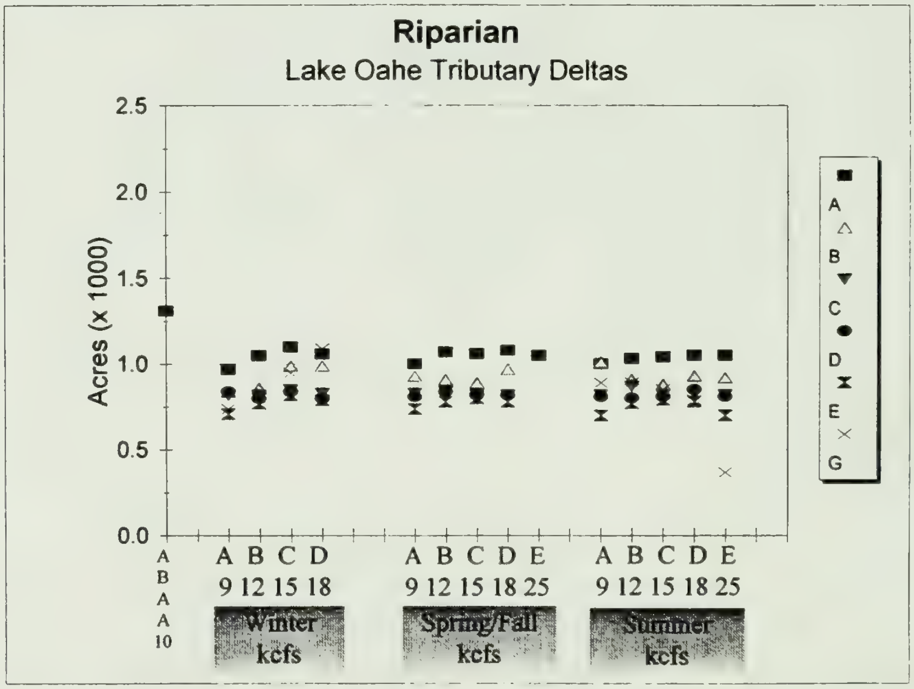

Figure 4-52. Average annual acreage of woody riparian vegetation in Lake Oahe tributary deltas for the Basic Set of alternatives by nonnavigation service level.

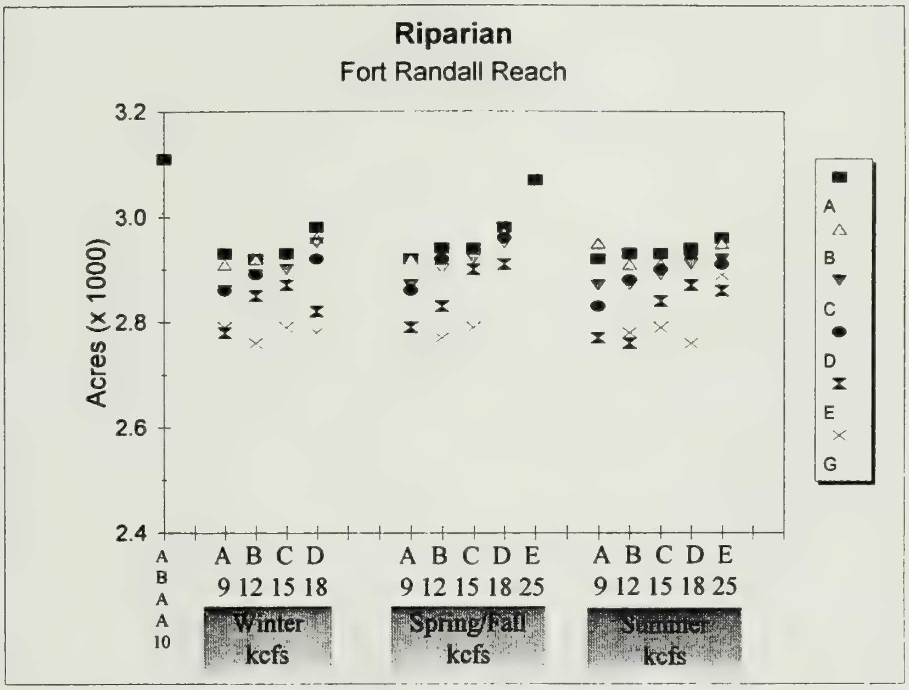

Figure 4-53. Average annual acreage of woody riparian vegetation in Fort Randall reach for the Basic Set of alternatives by nonnavigation service level.

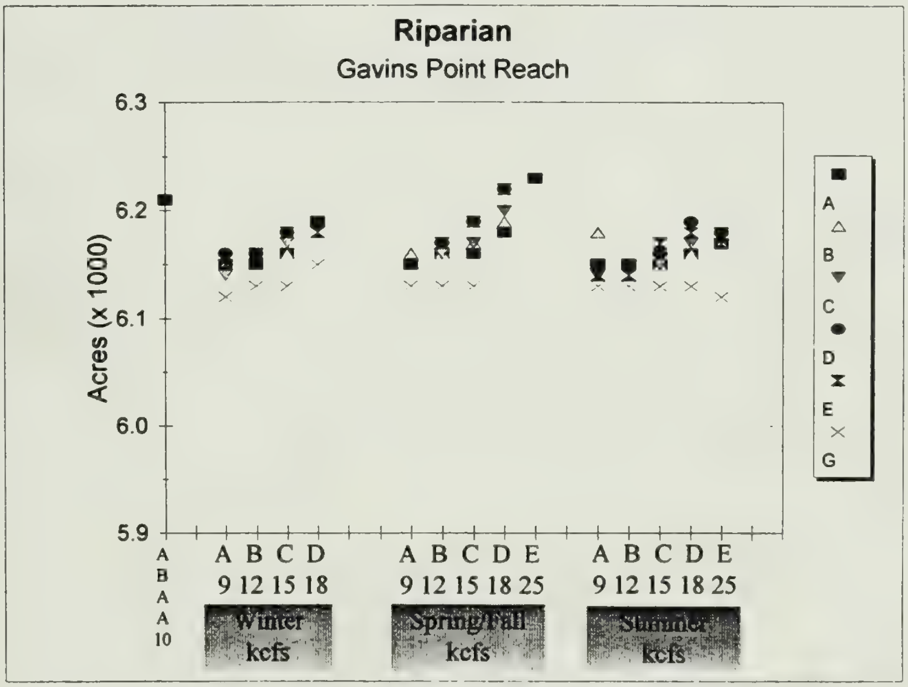

Figure 4-54. Average annual acreage of woody riparian vegetation in Gavins Point reach for the Basic Set of alternatives by nonnavigation service level.

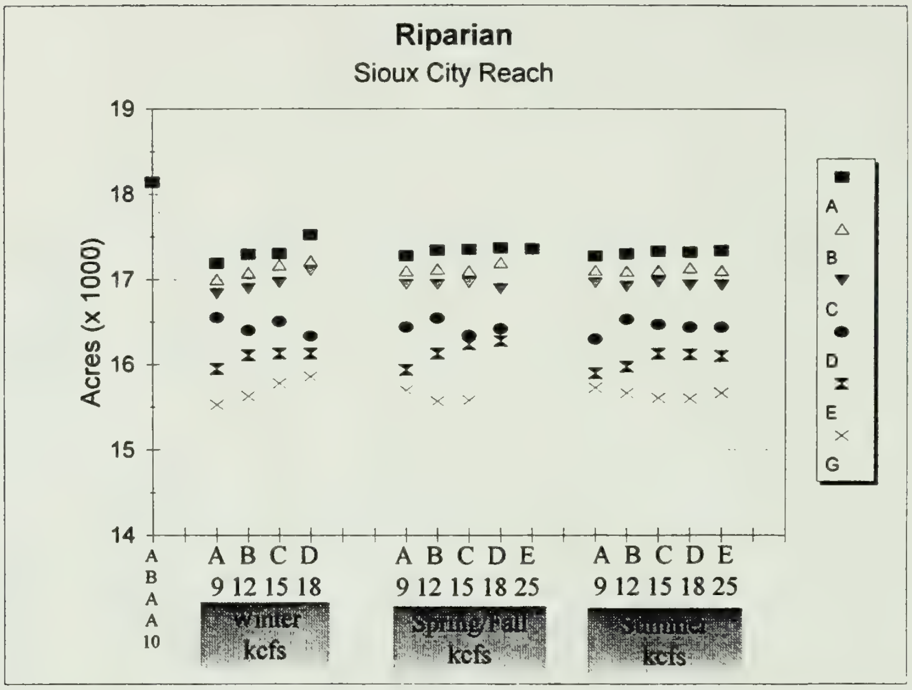

Figure 4-55. Average annual acreage of woody riparian vegetation in Sioux City reach for the Basic Set of alternatives by nonnavigation service level.

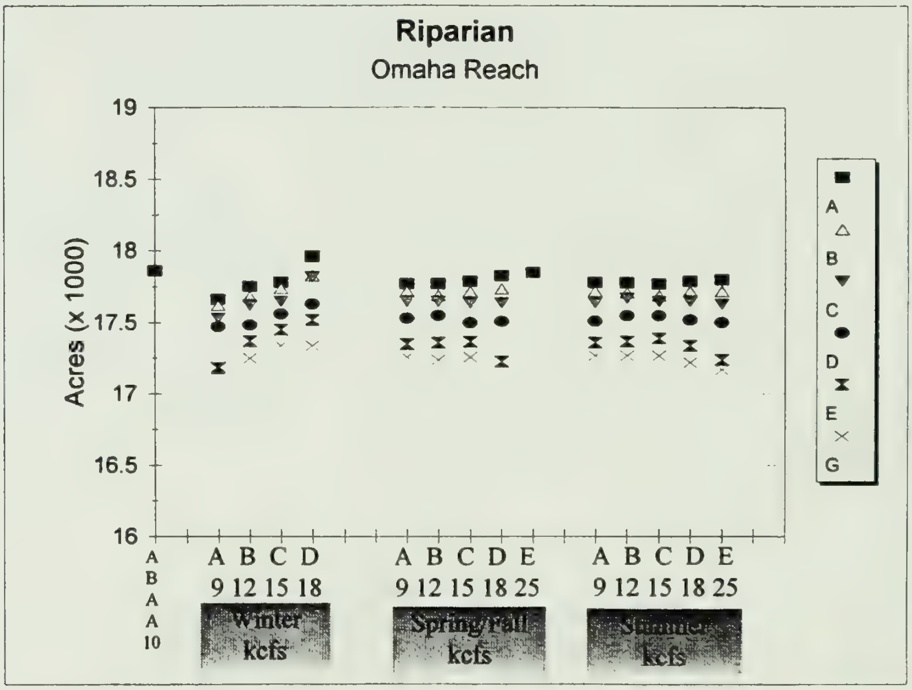

Figure 4-56. Average annual acreage of woody riparian vegetation in Omaha reach for the Basic Set of alternatives by nonnavigation service level.

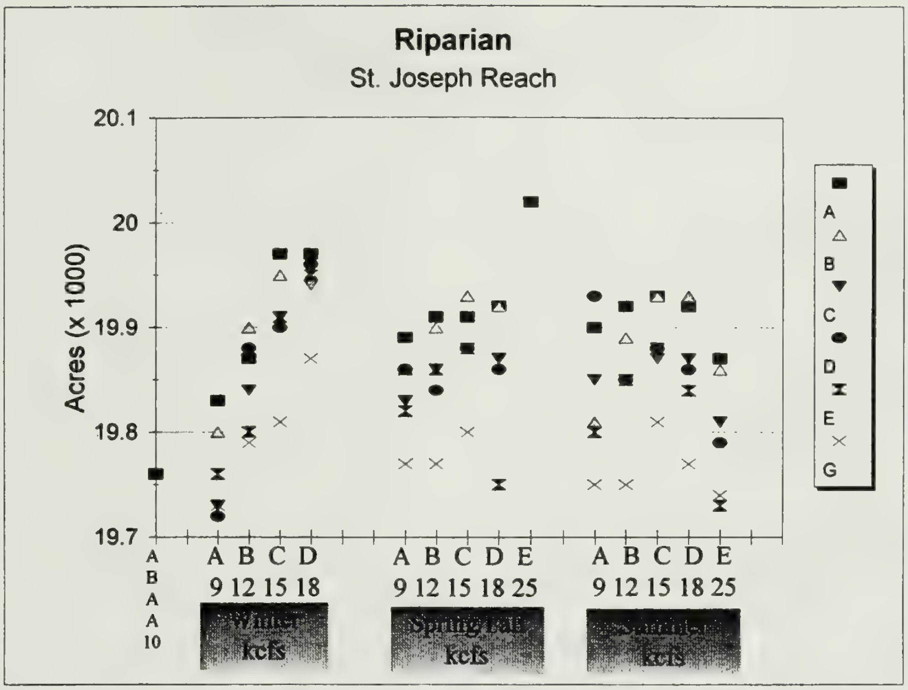

Figure 4-57. Average annual acreage of woody riparian vegetation in St. Joseph reach for the Basic Set of alternatives by nonnavigation service level.

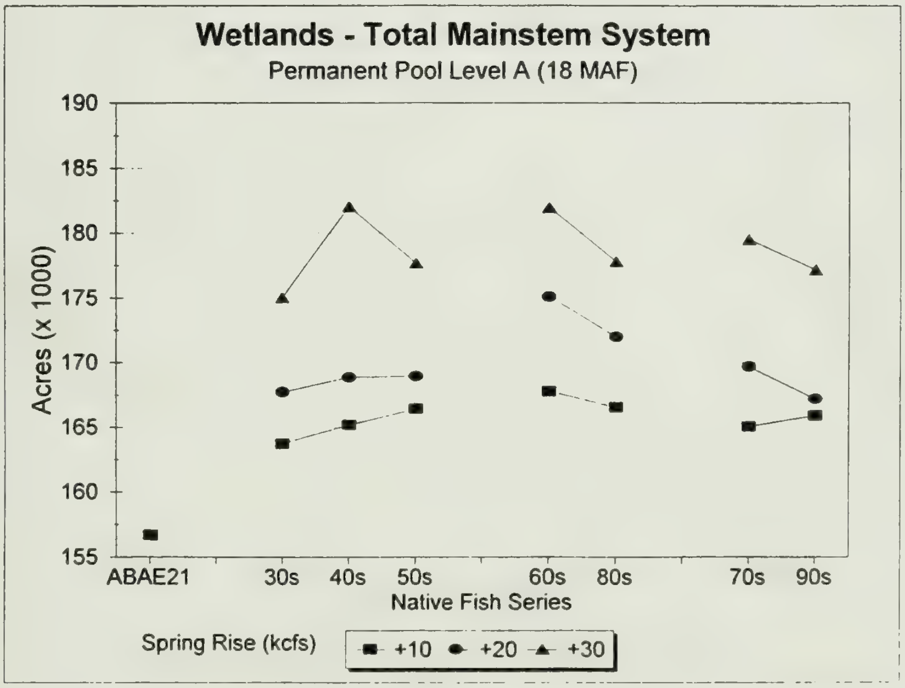

Figure 4-58. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

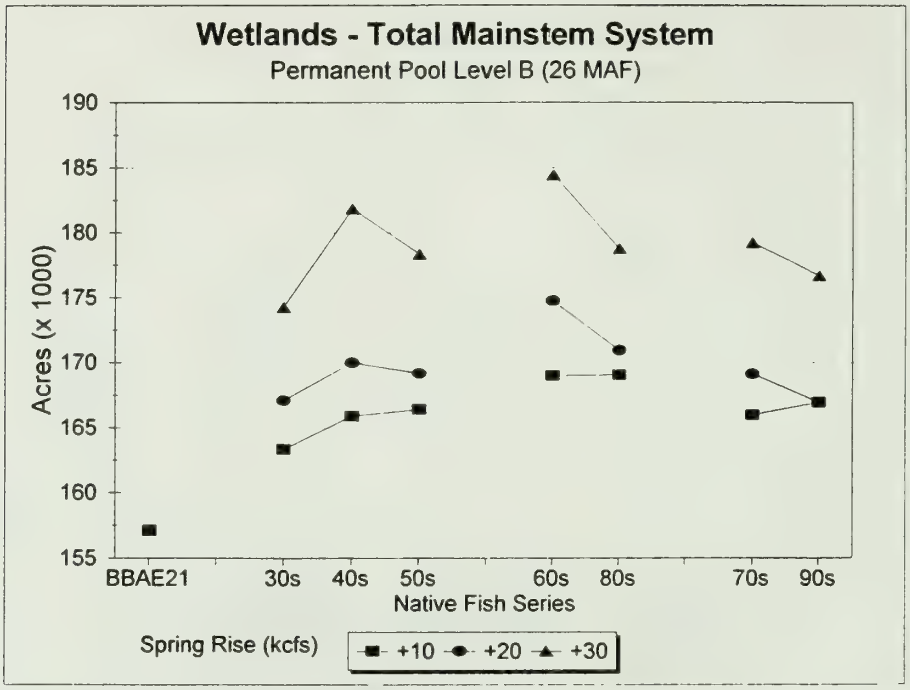

Figure 4-59. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

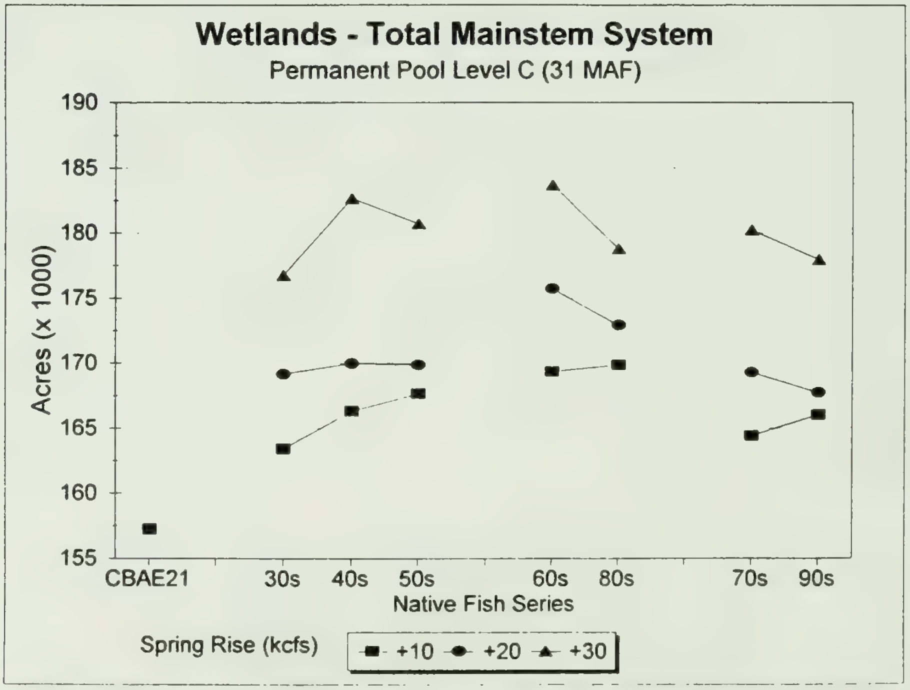

Figure 4-60. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

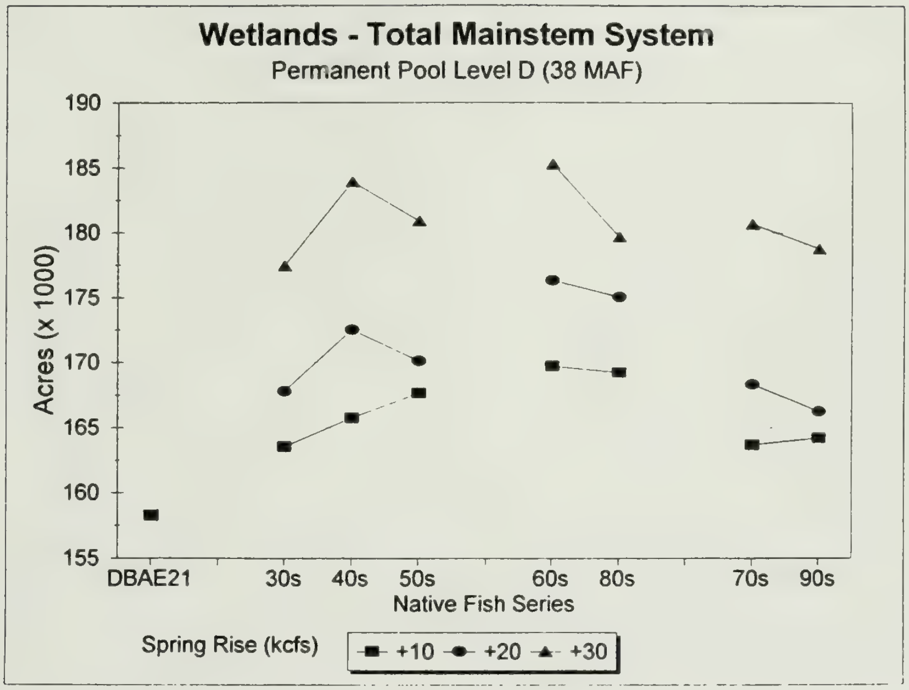

Figure 4-61. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

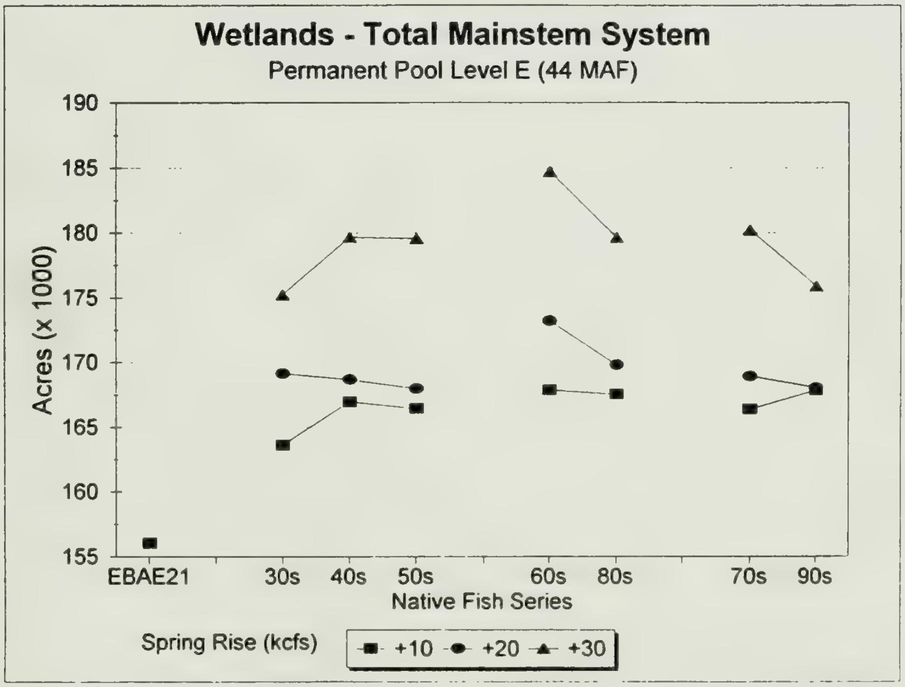

Figure 4-62. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

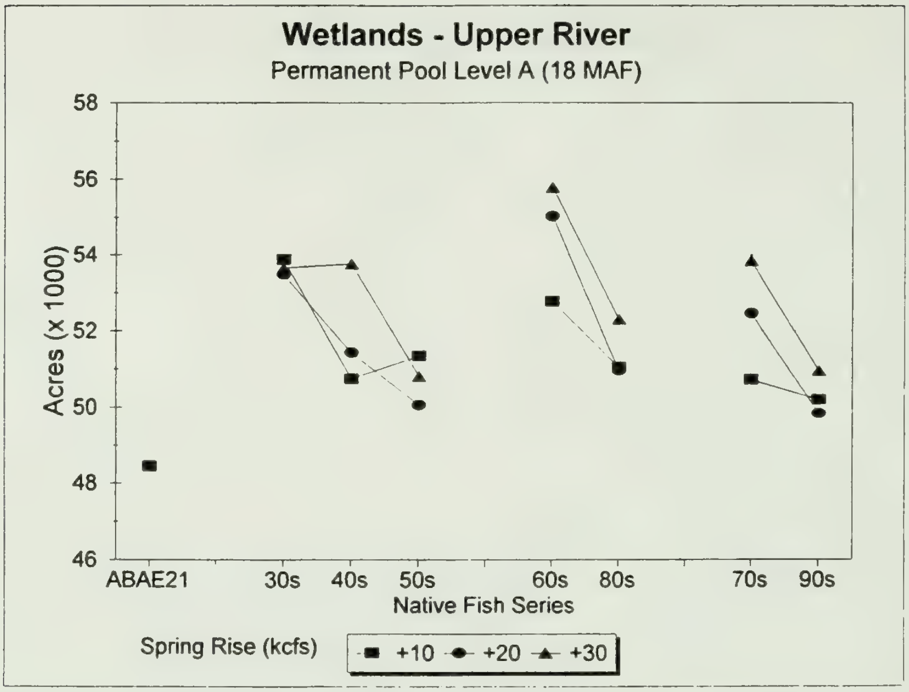

Figure 4-63. Average annual wetland acreage in upper river sections of the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

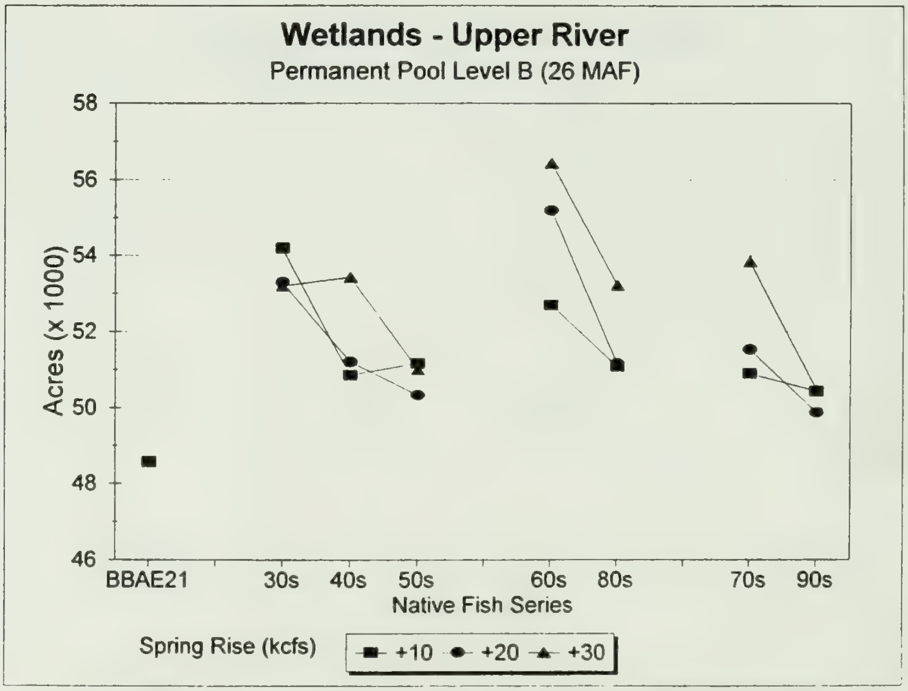

Figure 4-64. Average annual wetland acreage in upper river sections of the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

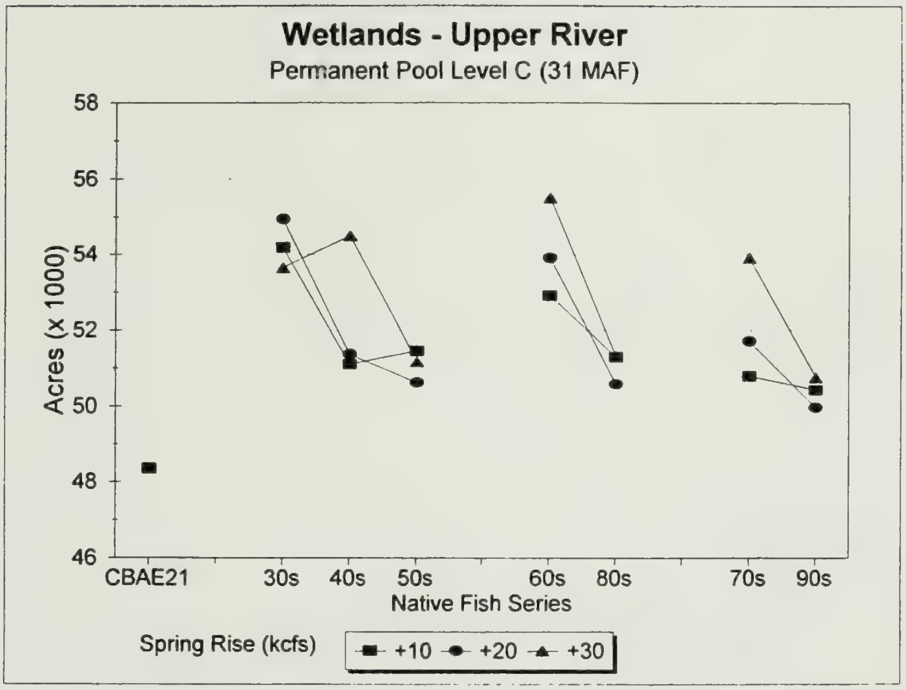

Figure 4-65. Average annual wetland acreage in upper river sections of the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

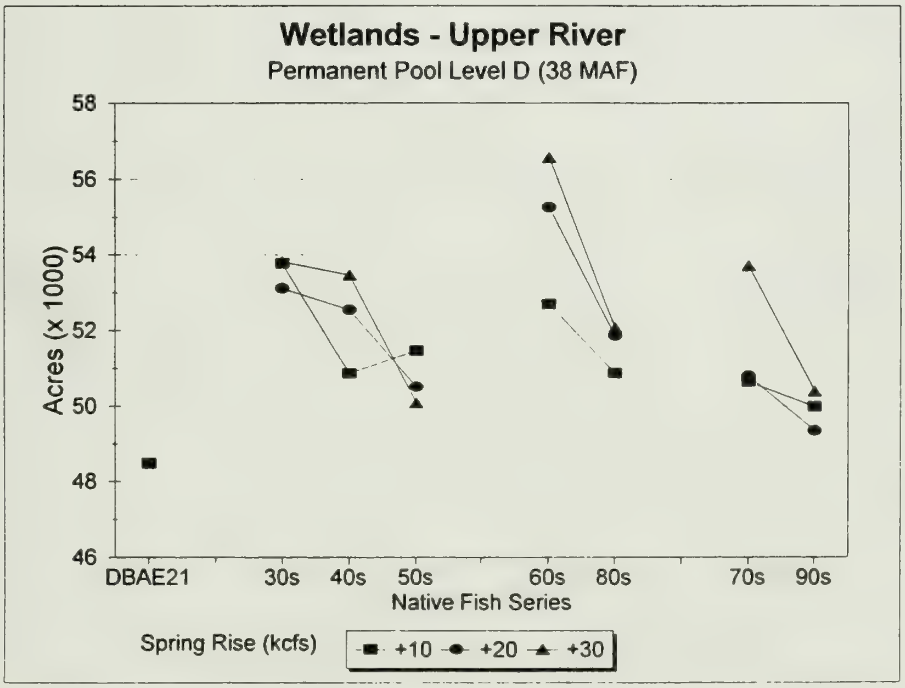

Figure 4-66. Average annual wetland acreage in upper river sections of the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

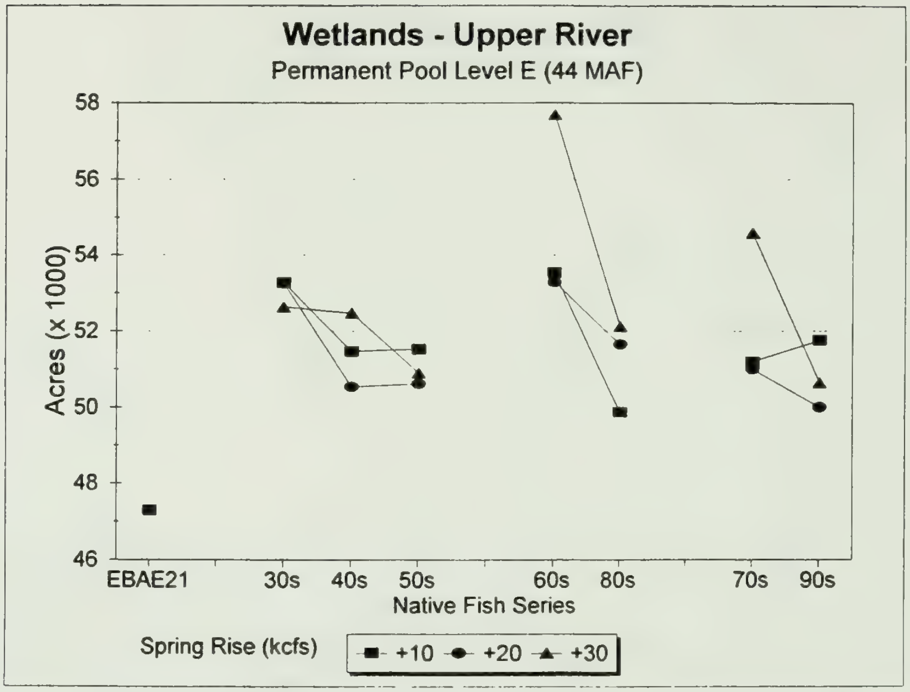

Figure 4-67. Average annual wetland acreage in upper river sections of the Mainstem System over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

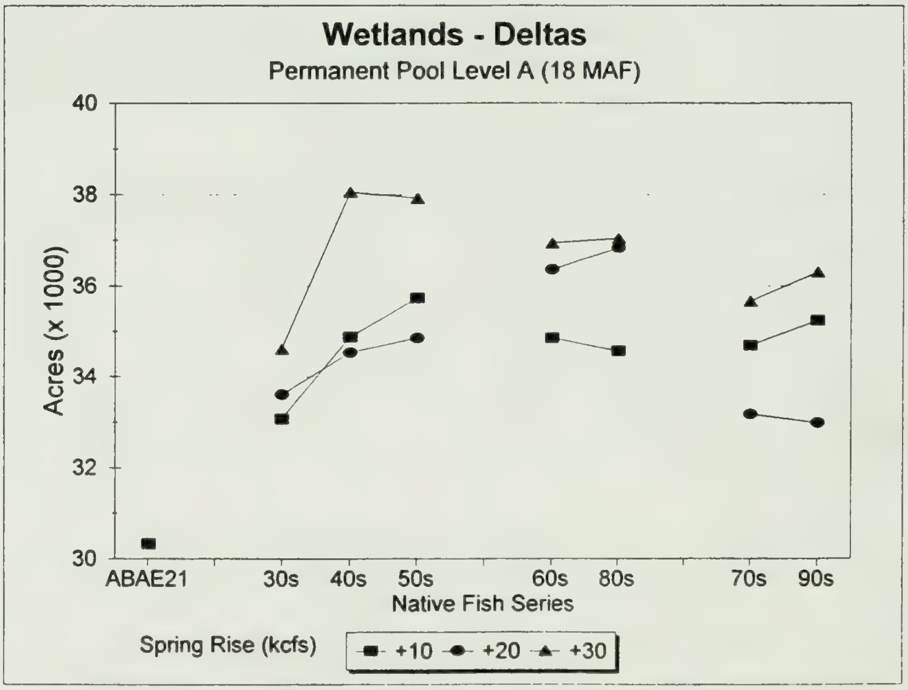

Figure 4-68. Average annual wetland acreage in Missouri River deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

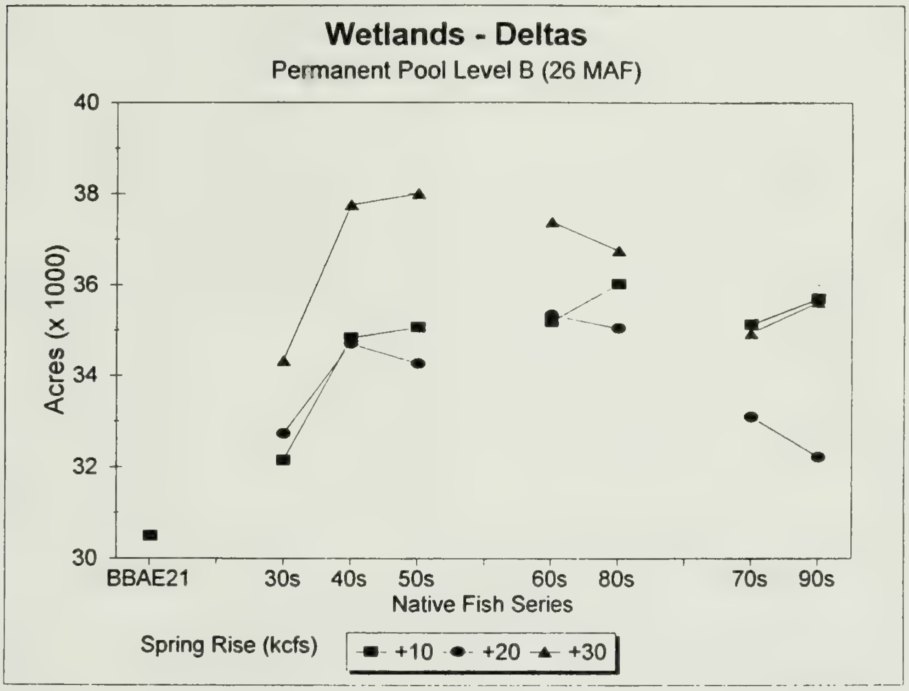

Figure 4-69. Average annual wetland acreage in Missouri River deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

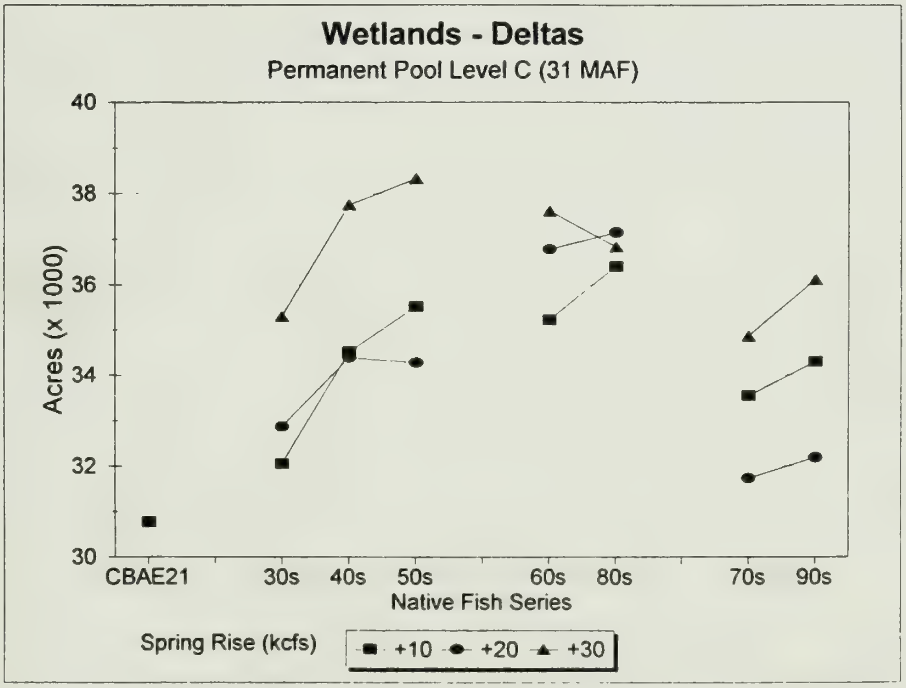

Figure 4-70. Average annual wetland acreage in Missouri River deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

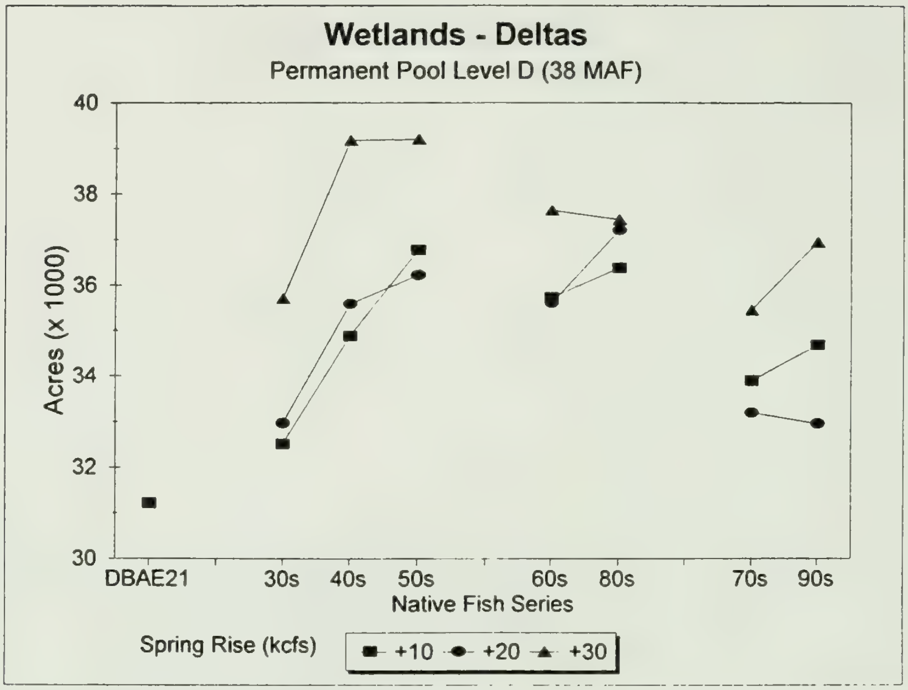

Figure 4-71. Average annual wetland acreage in Missouri River deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

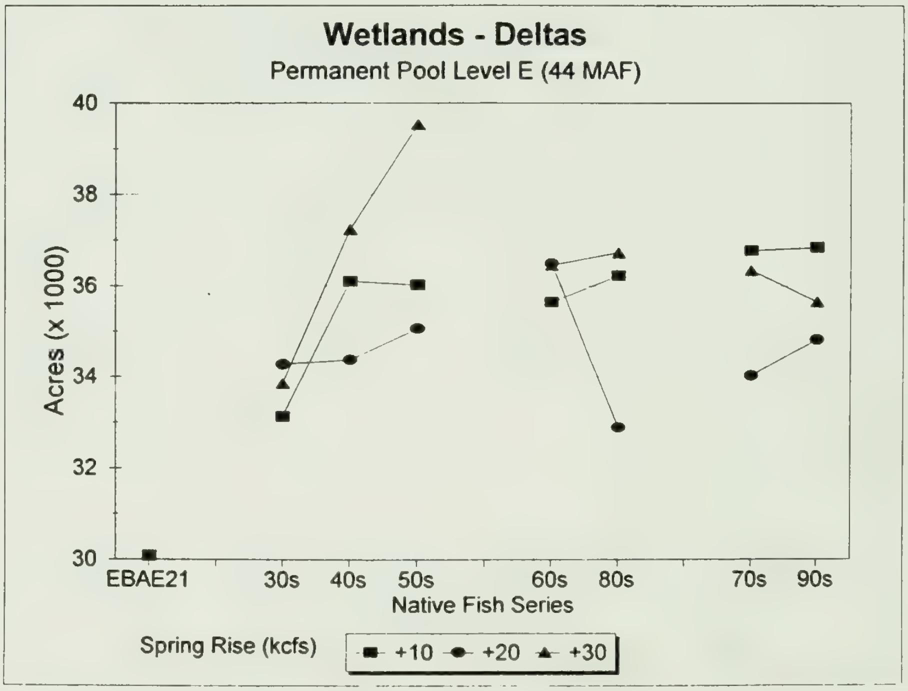

Figure 4-72. Average annual wetland acreage in Missouri River deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

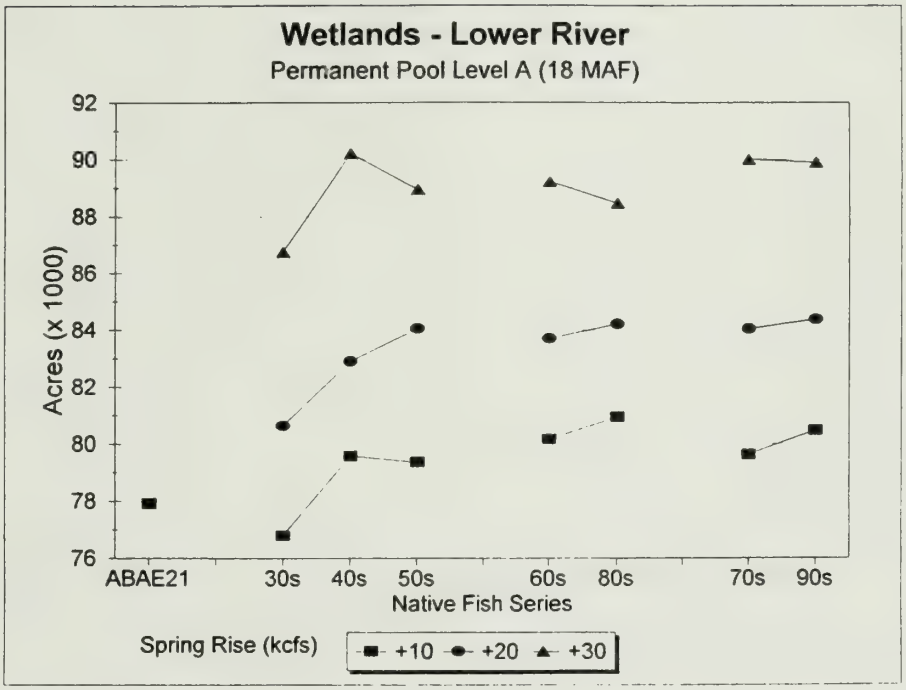

Figure 4-73. Average annual wetland acreage in lower Missouri River over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

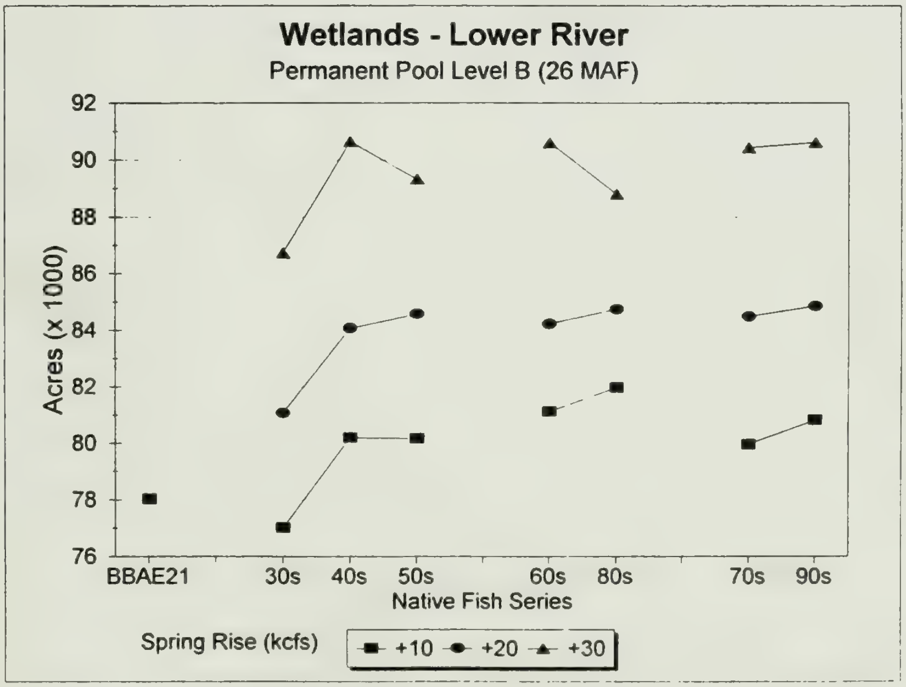

Figure 4-74. Average annual wetland acreage in lower Missouri River over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

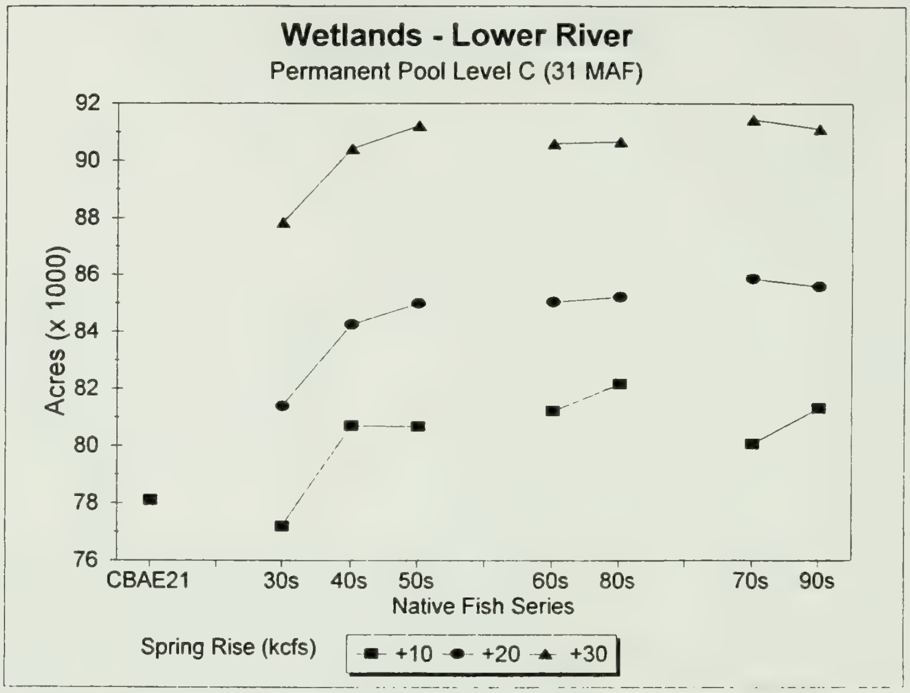

Figure 4-75. Average annual wetland acreage in lower Missouri River over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

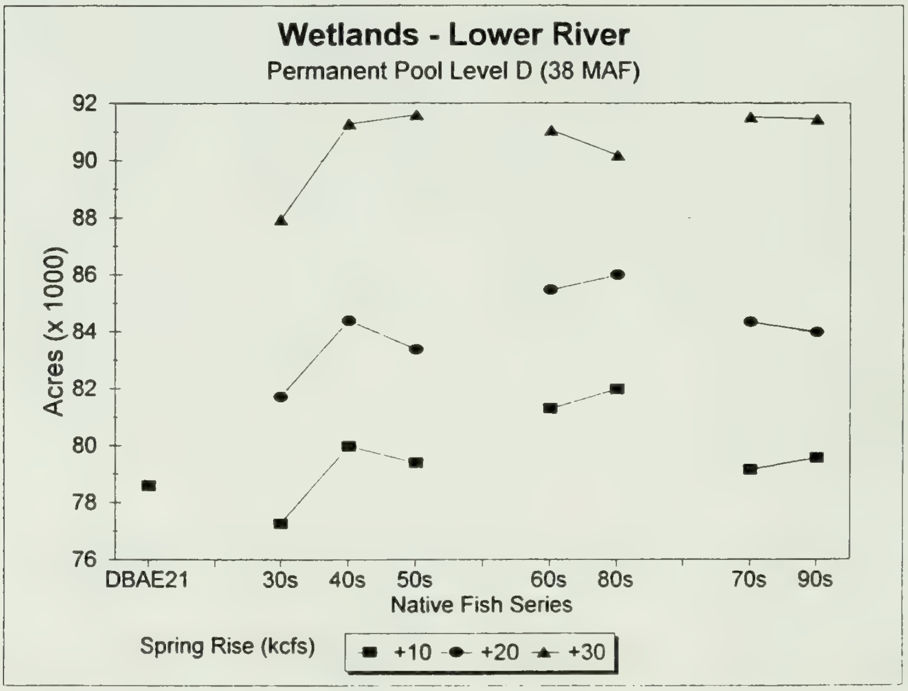

Figure 4-76. Average annual wetland acreage in lower Missouri River over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

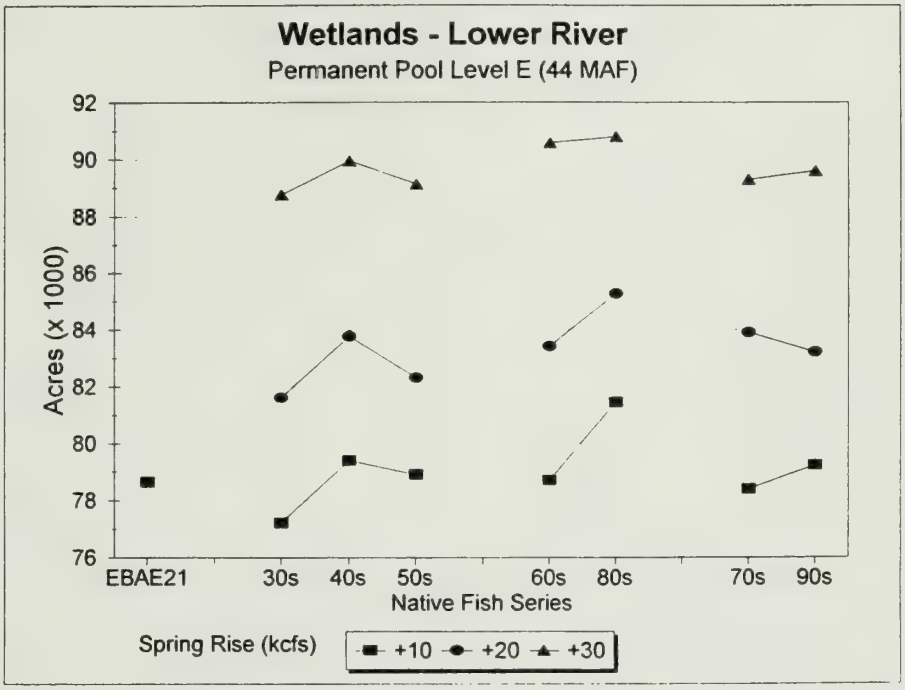

Figure 4-77. Average annual wetland acreage in lower Missouri River over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

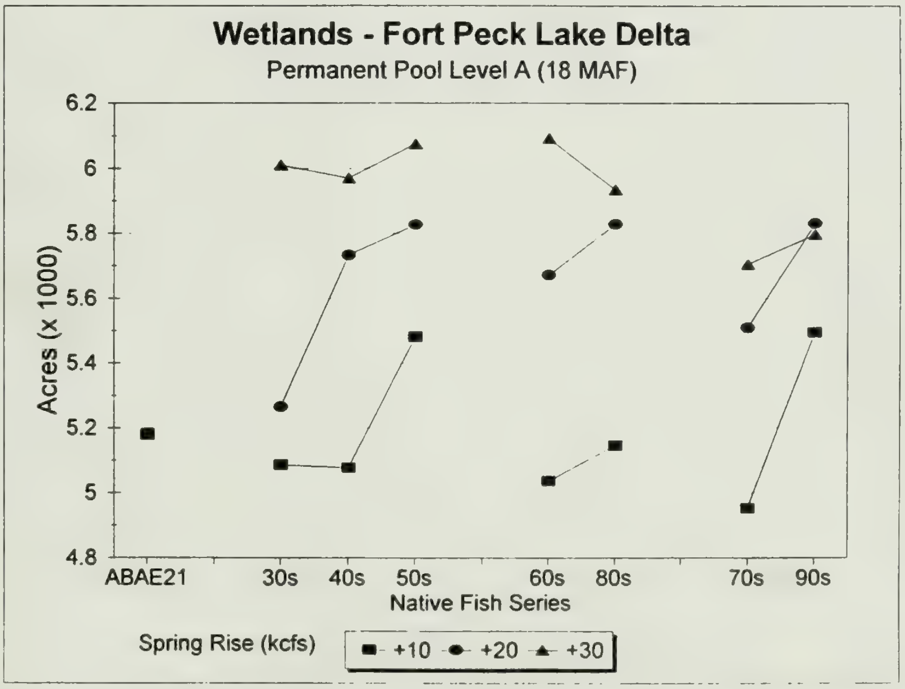

Figure 4-78. Average annual wetland acreage in Fort Peck Lake delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

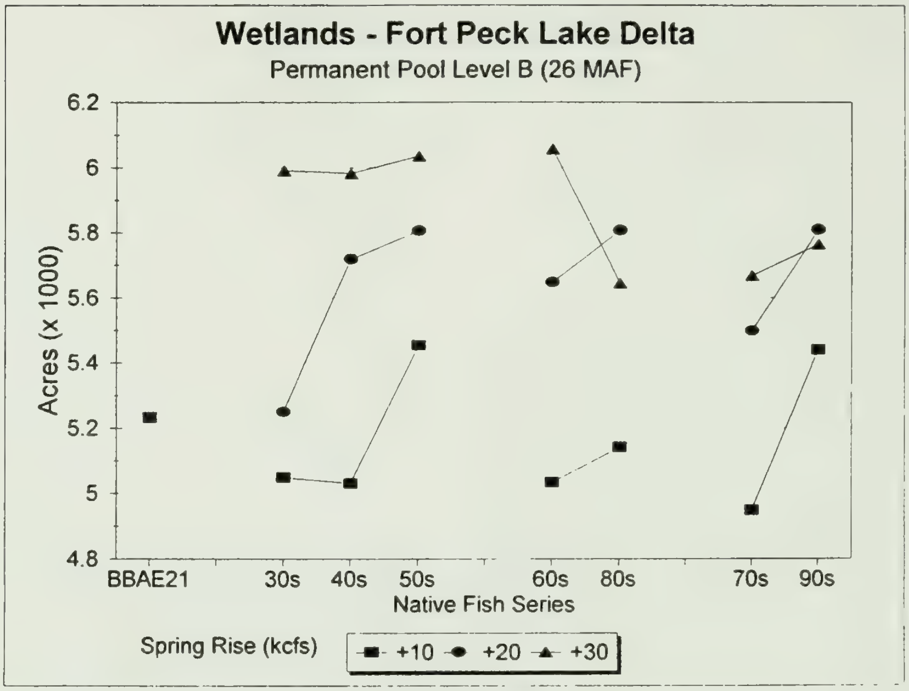

Figure 4-79. Average annual wetland acreage in Fort Peck Lake delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

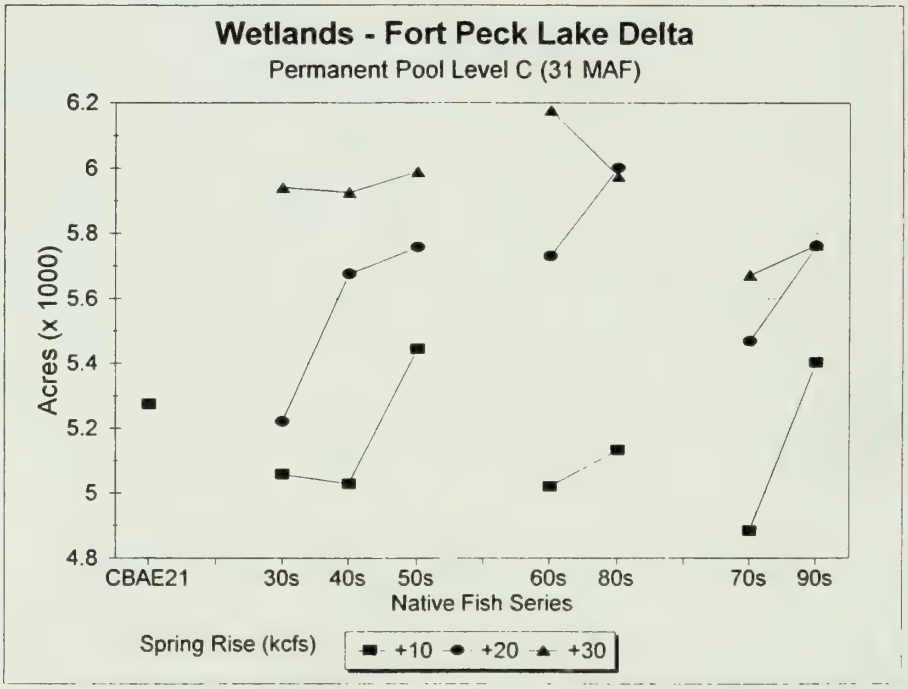

Figure 4-80. Average annual wetland acreage in Fort Peck Lake delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

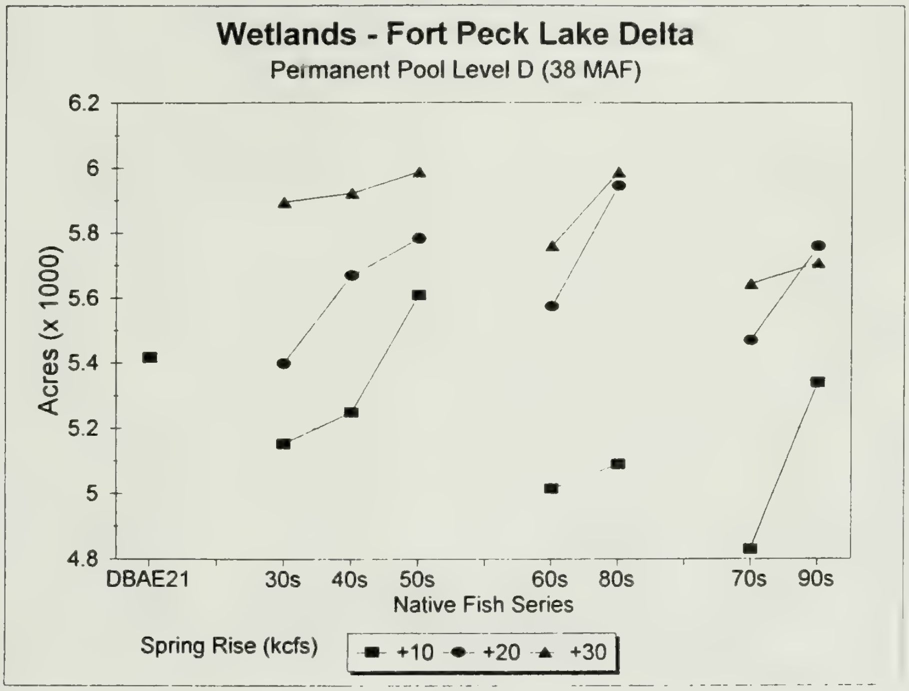

Figure 4-81. Average annual wetland acreage in Fort Peck Lake delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

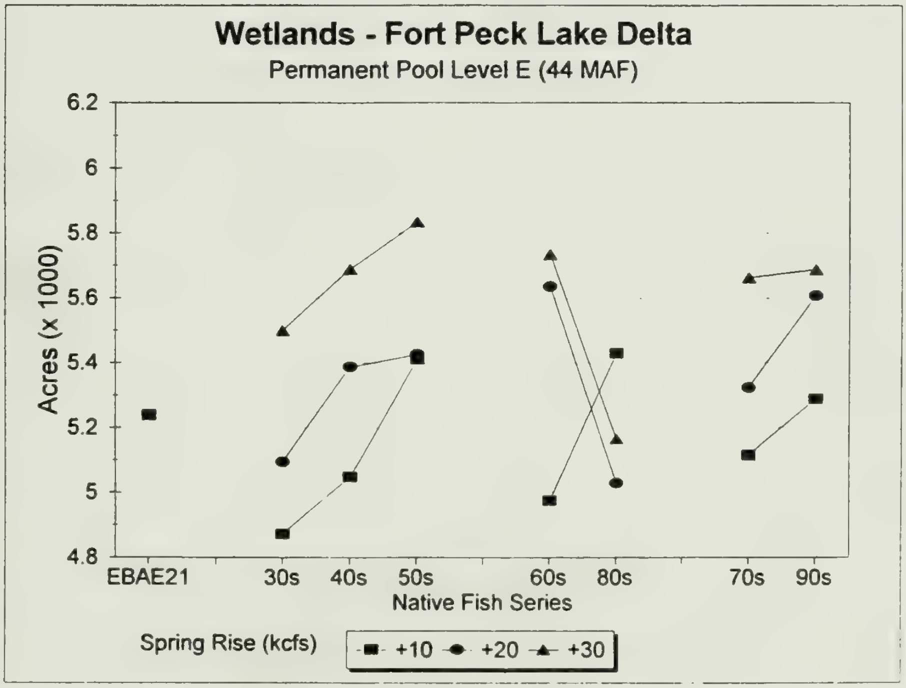

Figure 4-82. Average annual wetland acreage in Fort Peck Lake delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

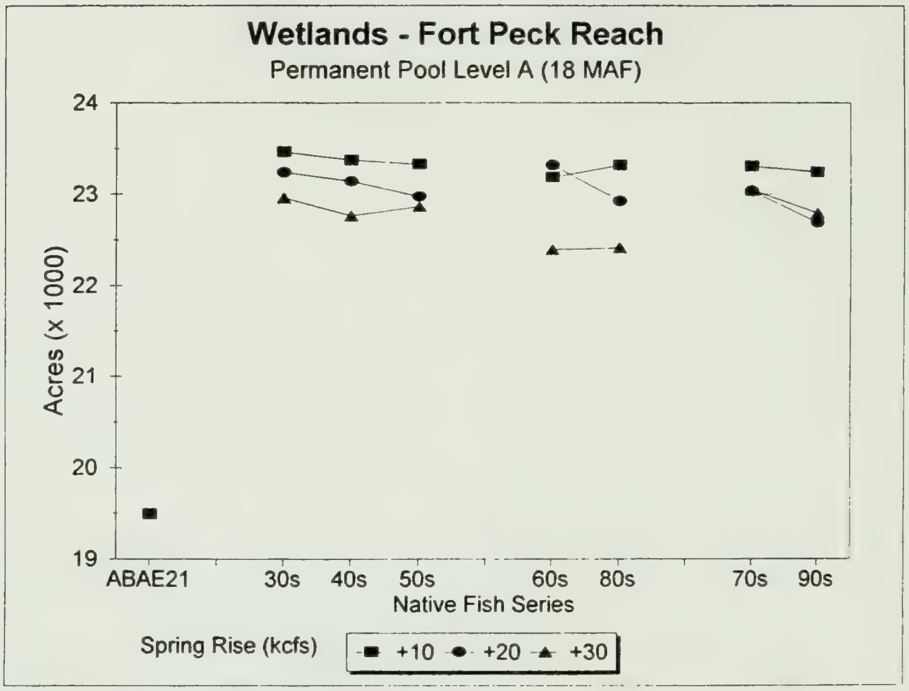

Figure 4-83. Average annual wetland acreage in Fort Peck reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

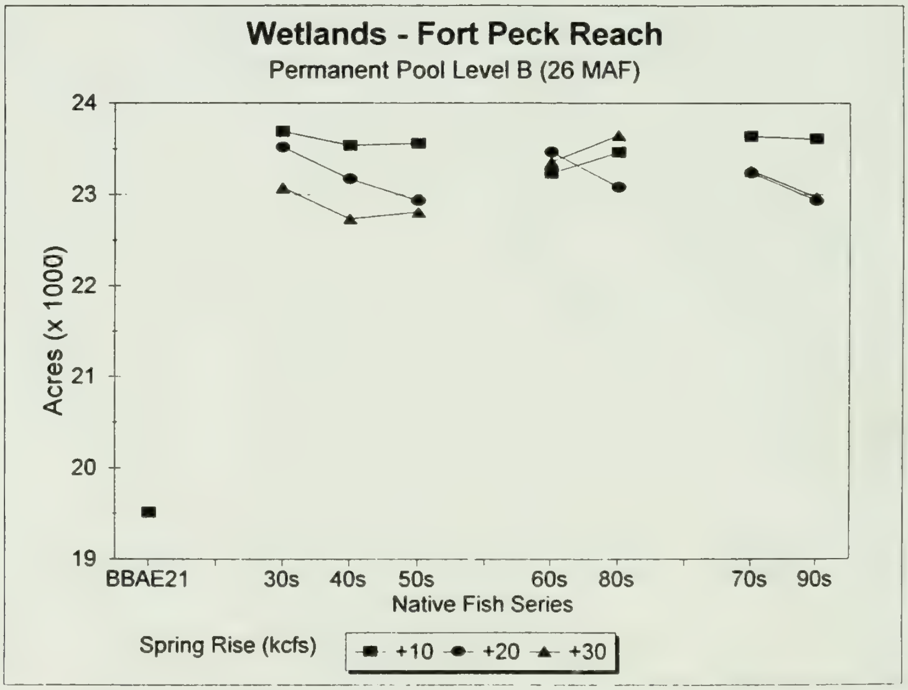

Figure 4-84. Average annual wetland acreage in Fort Peck reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

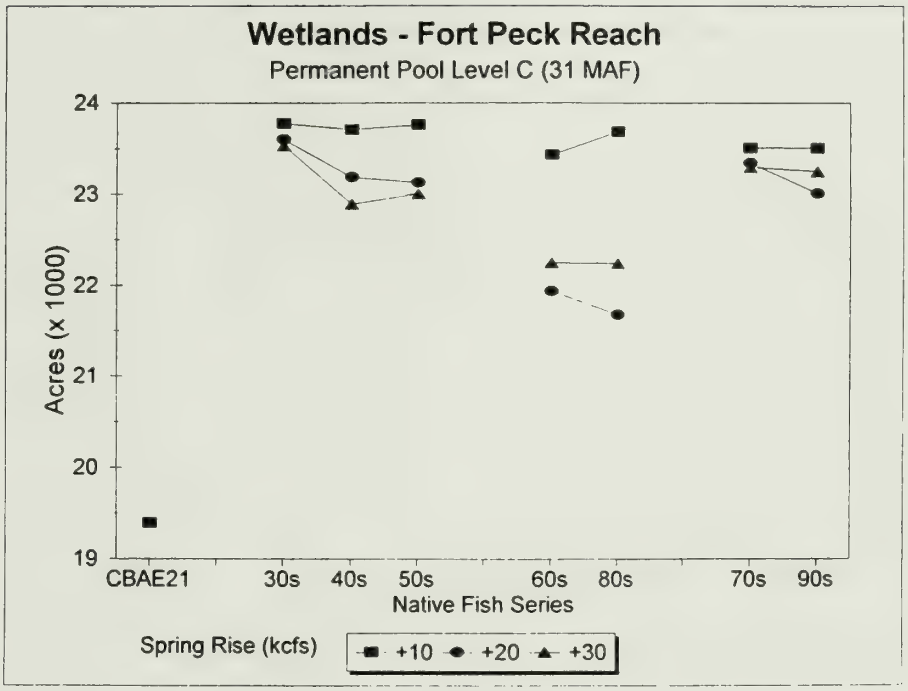

Figure 4-85. Average annual wetland acreage in Fort Peck reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

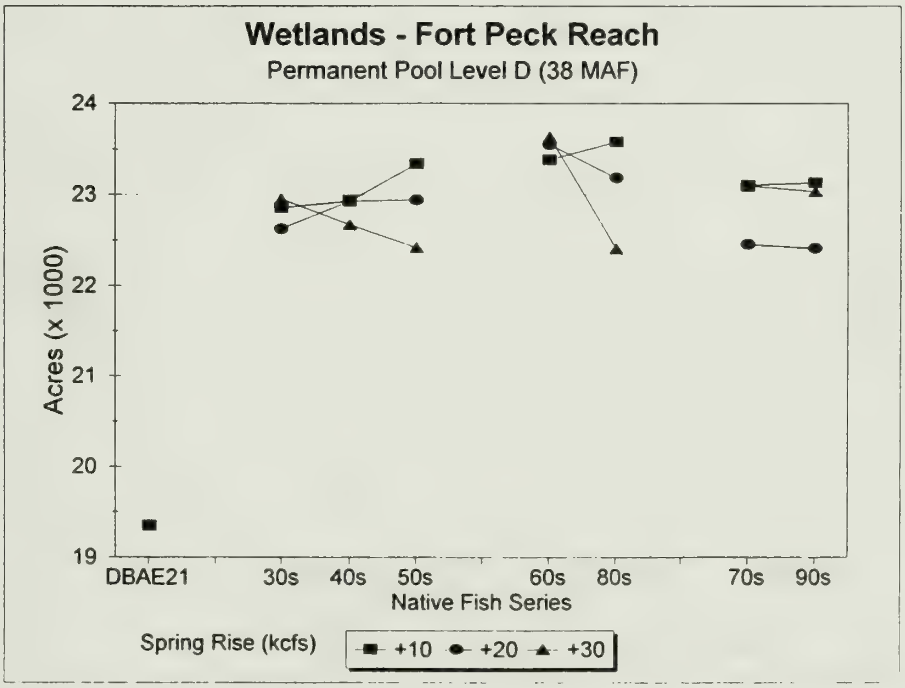

Figure 4-86. Average annual wetland acreage in Fort Peck reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

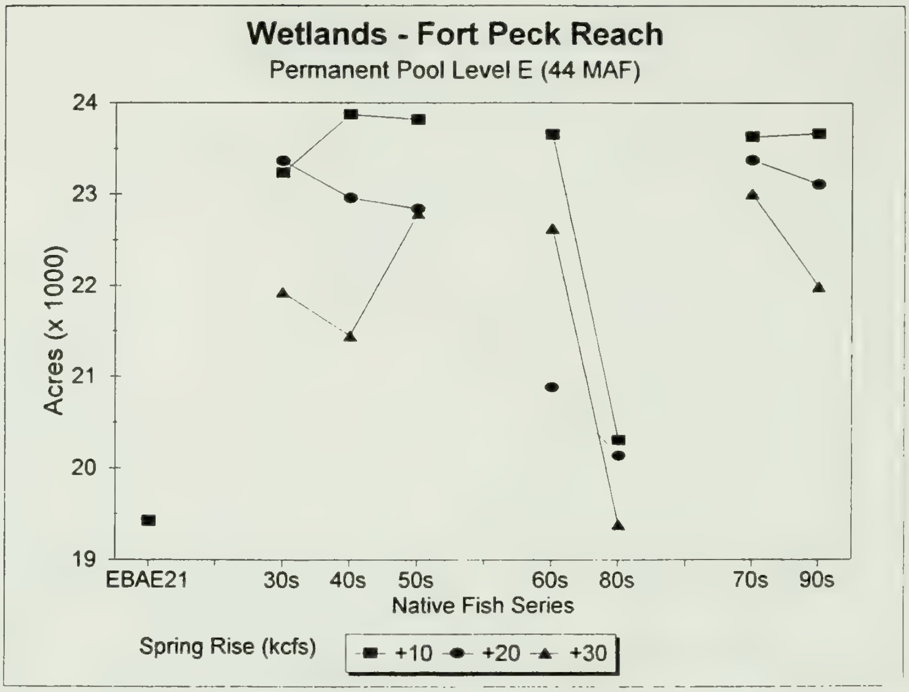

Figure 4-87. Average annual wetland acreage in Fort Peck reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

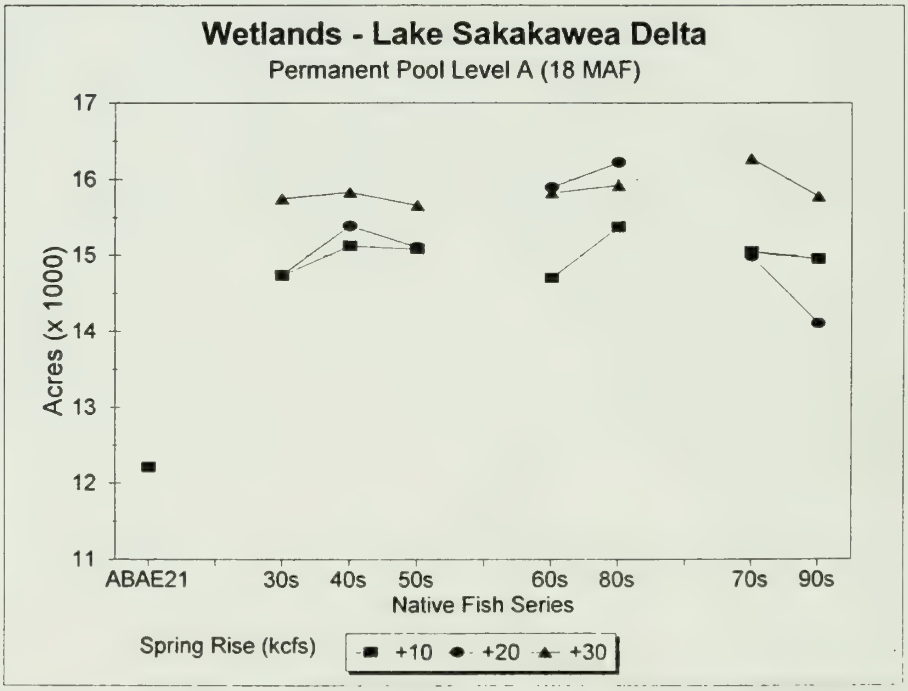

Figure 4-88. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

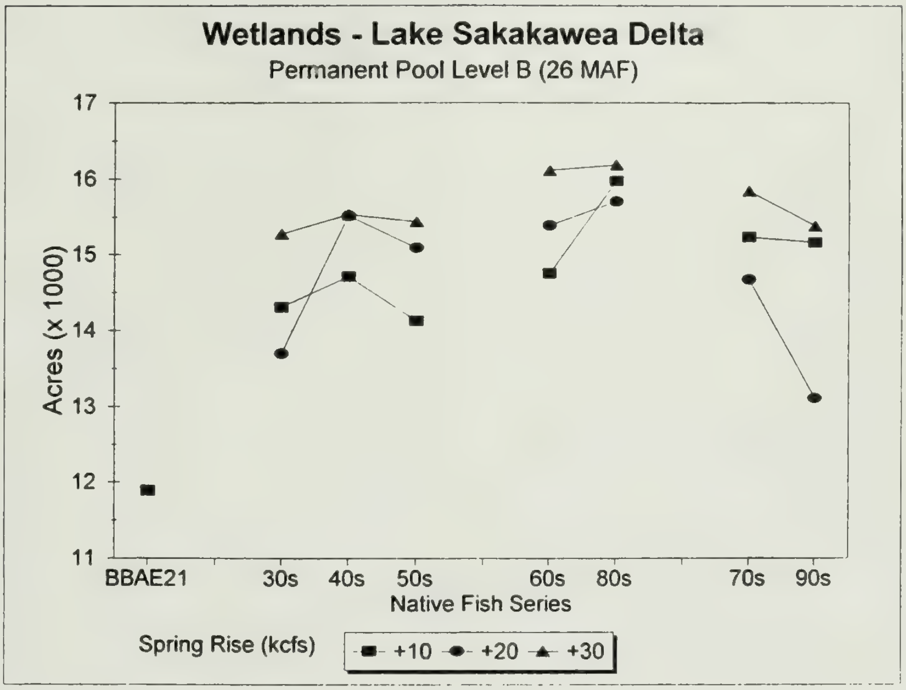

Figure 4-89. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

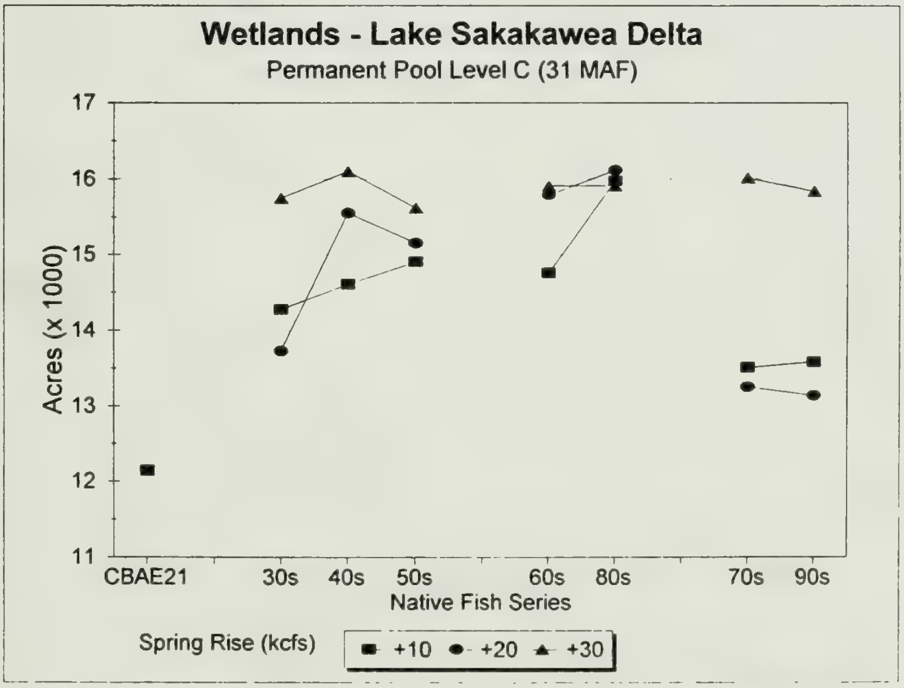

Figure 4-90. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

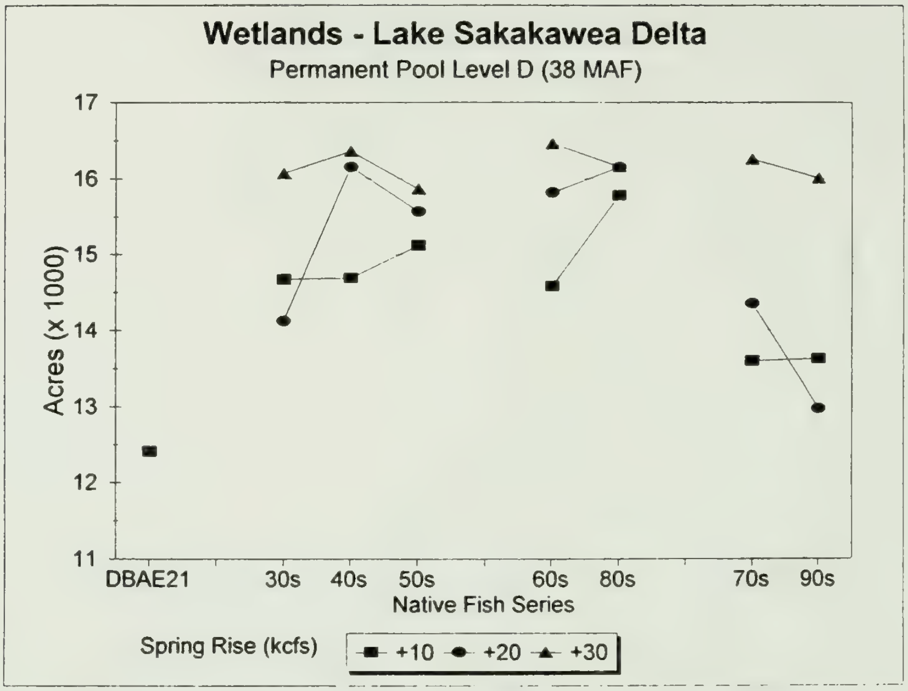

Figure 4-91. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

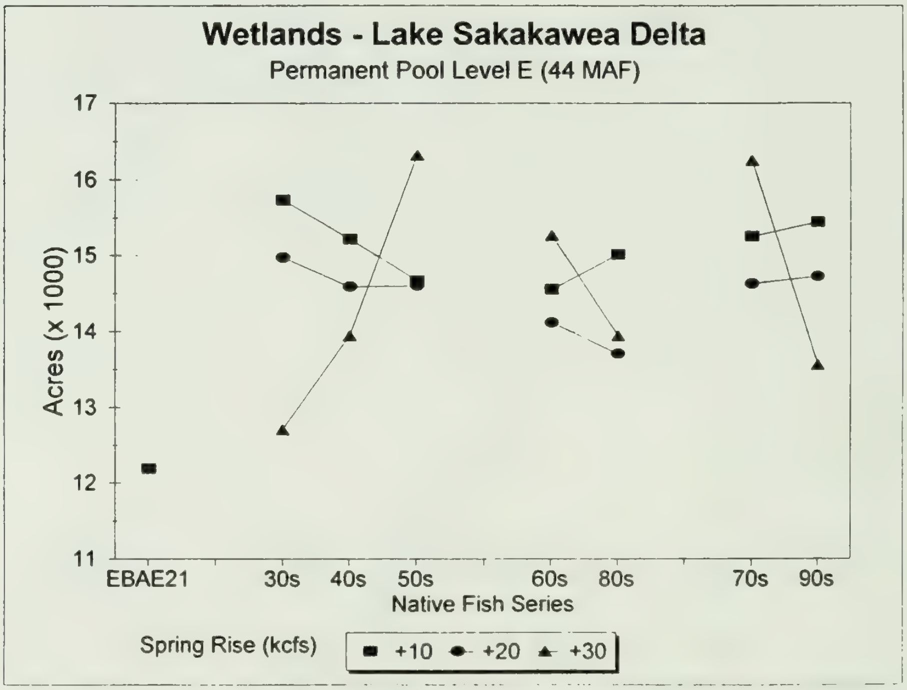

Figure 4-92. Average annual wetland acreage in Lake Sakakawea delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

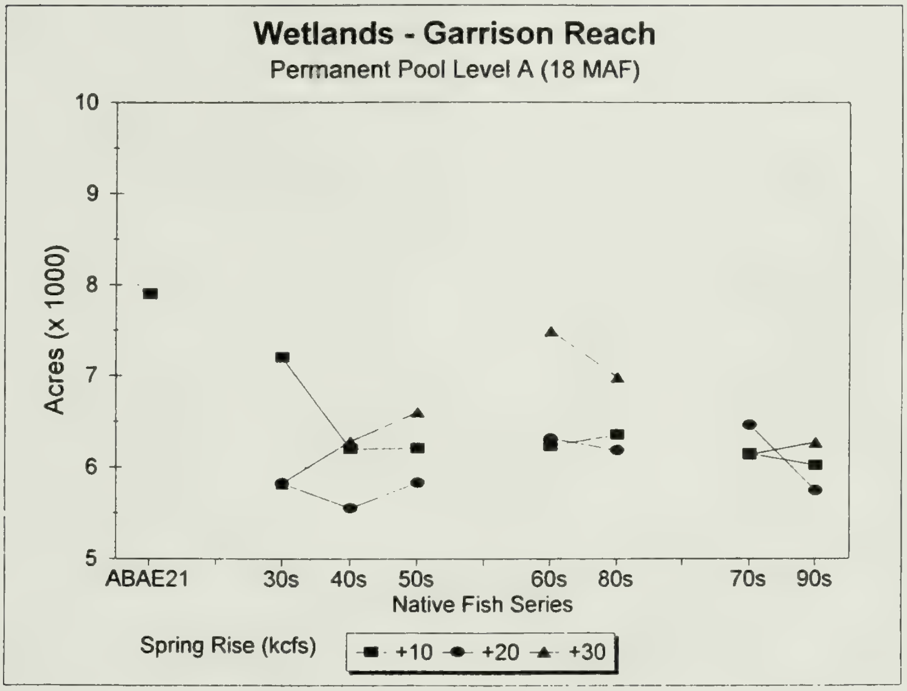

Figure 4-93. Average annual wetland acreage in Garrison reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

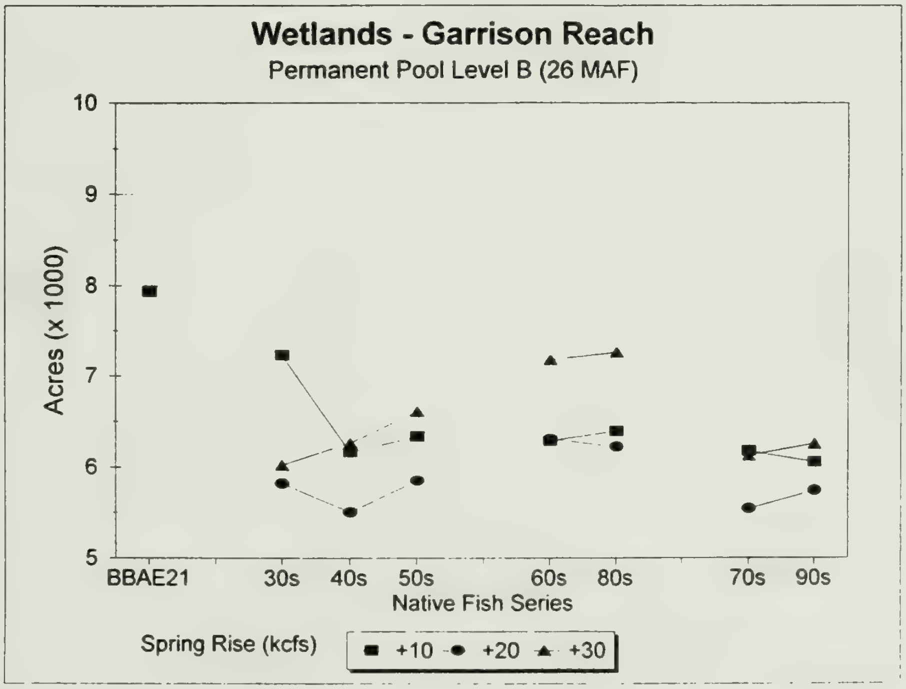

Figure 4-94. Average annual wetland acreage in Garrison reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

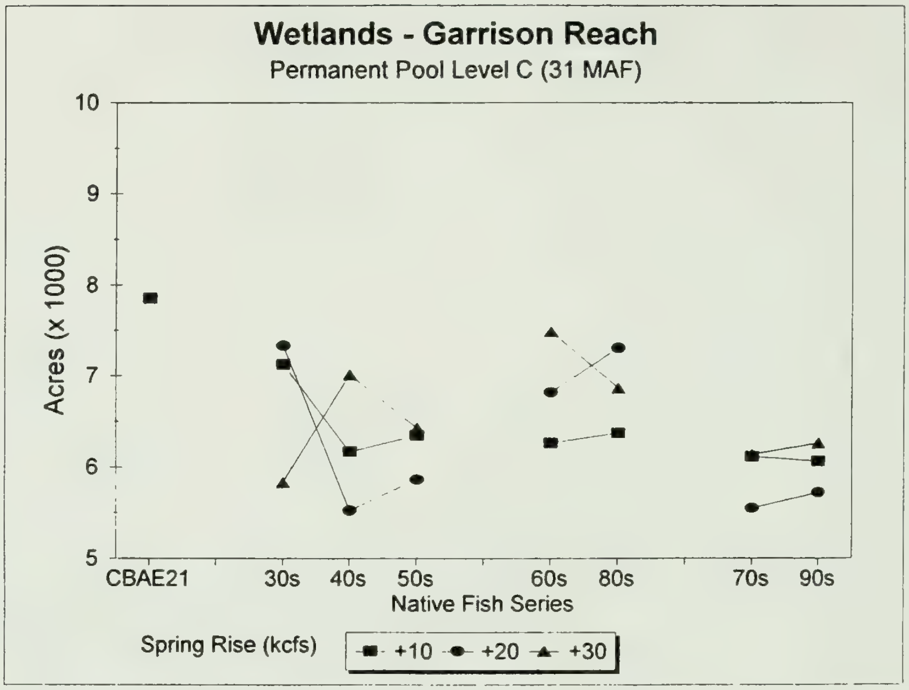

Figure 4-95. Average annual wetland acreage in Garrison reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

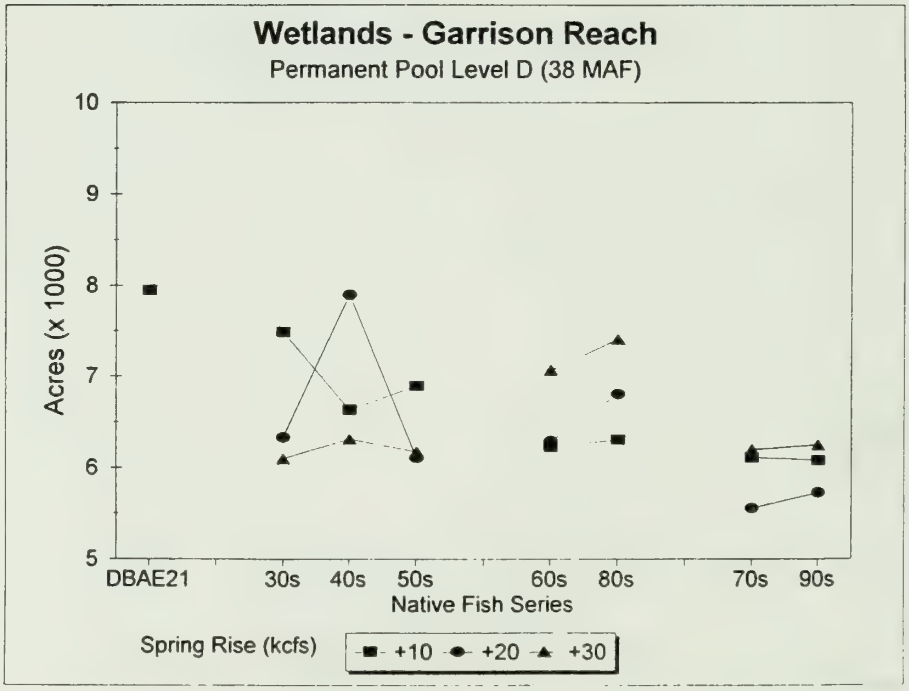

Figure 4-96. Average annual wetland acreage in Garrison reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

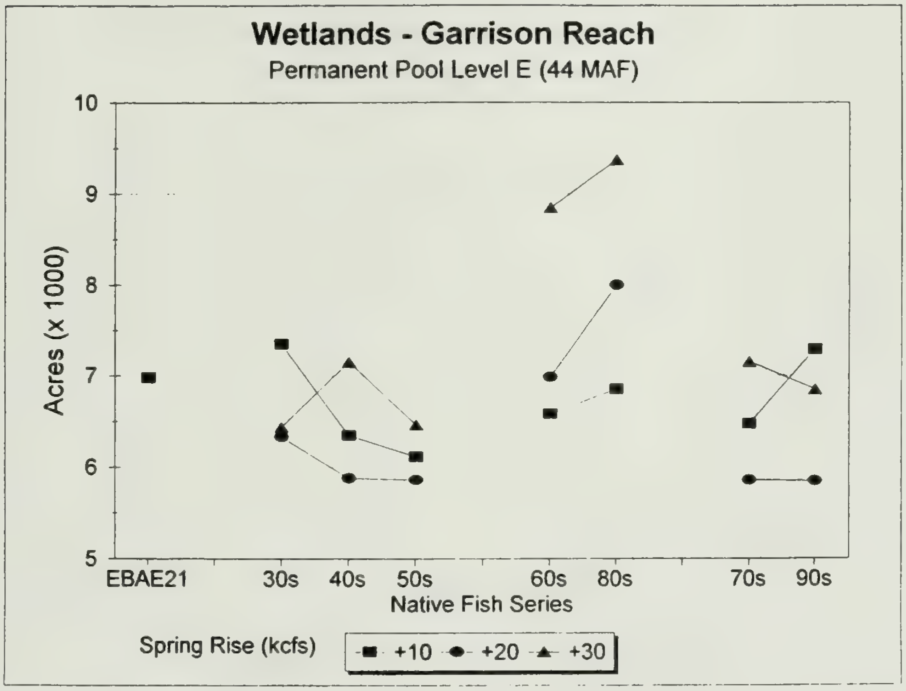

Figure 4-97. Average annual wetland acreage in Garrison reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

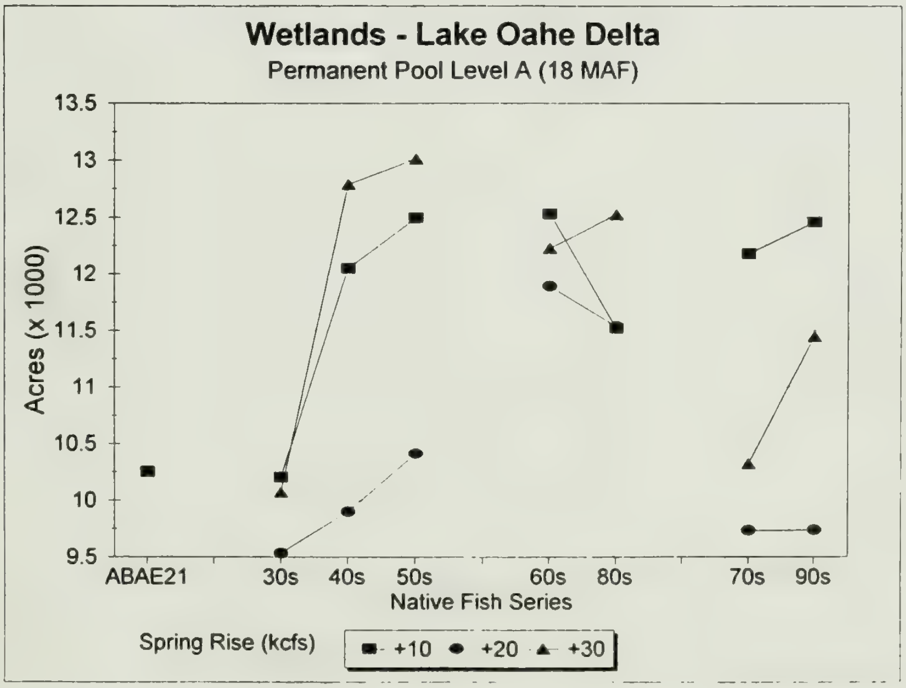

Figure 4-98. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

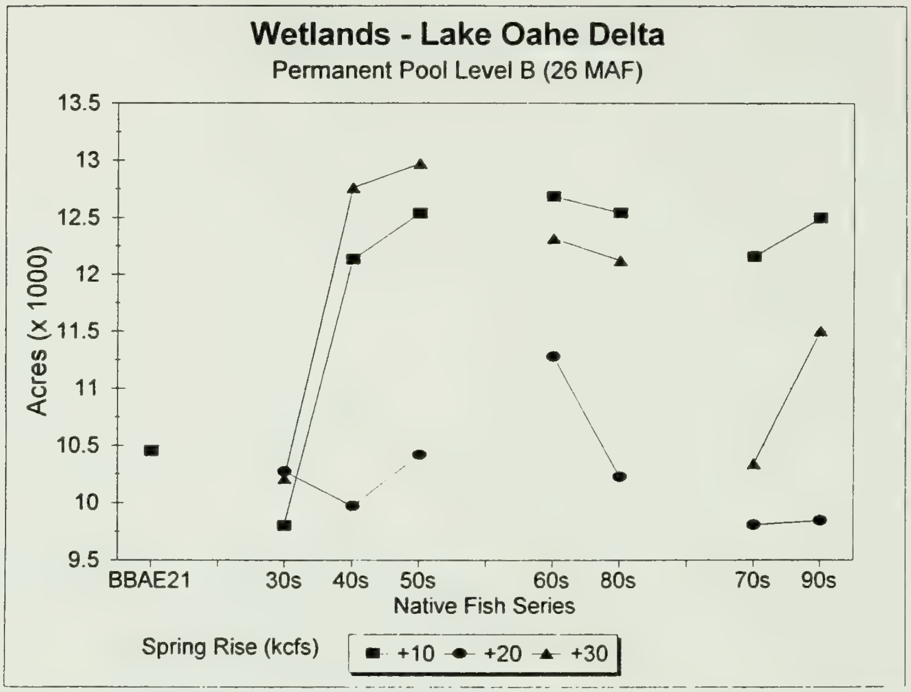

Figure 4-99. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

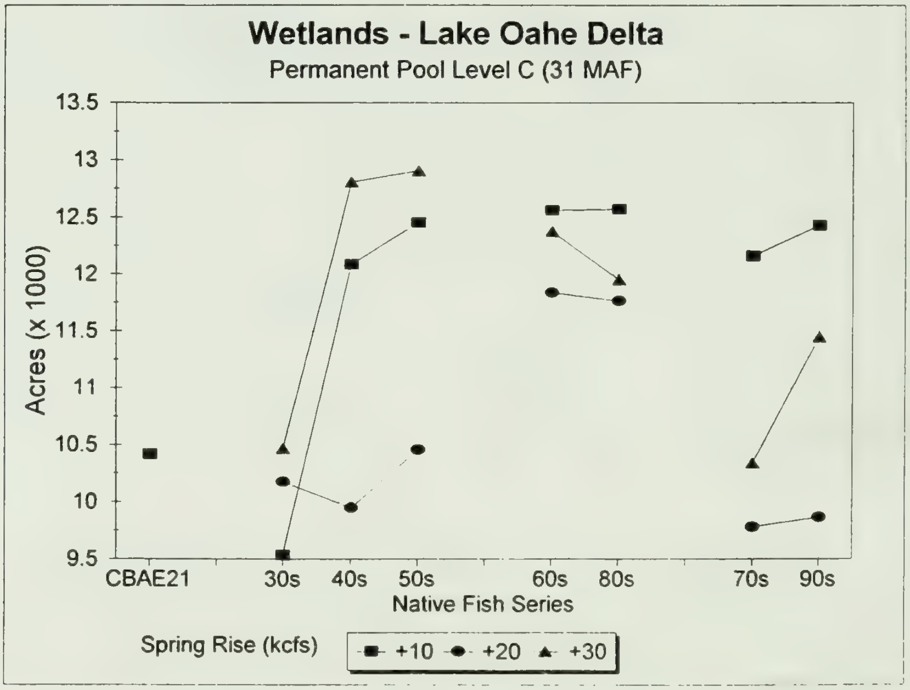

Figure 4-100. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

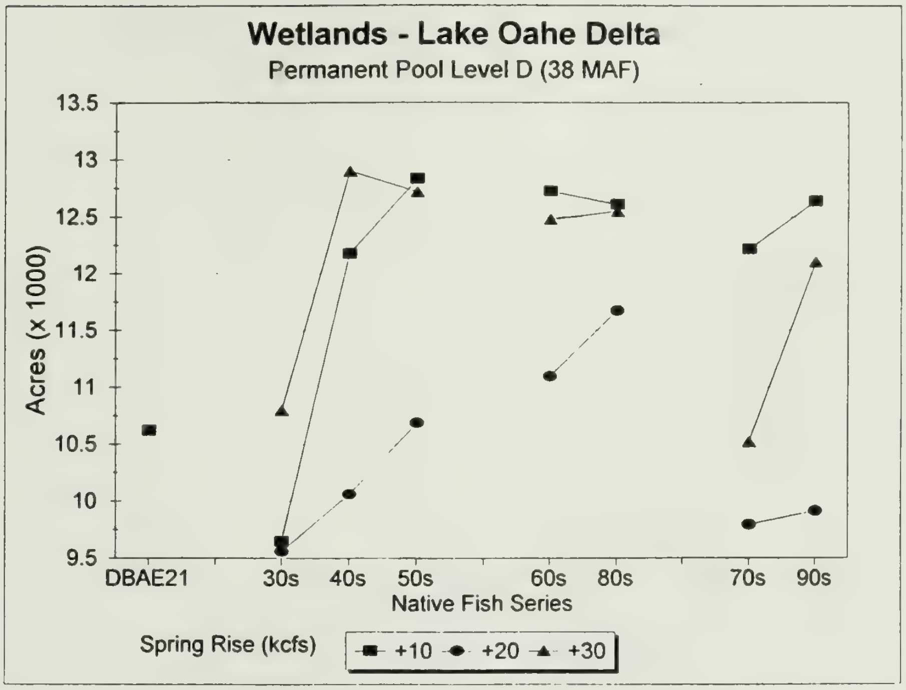

Figure 4-101. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

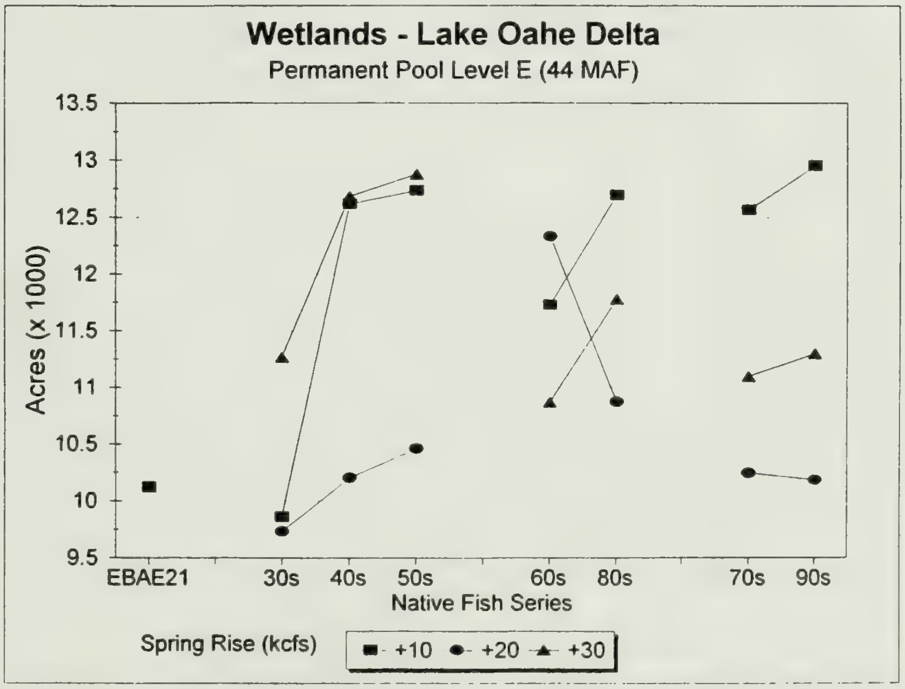

Figure 4-102. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

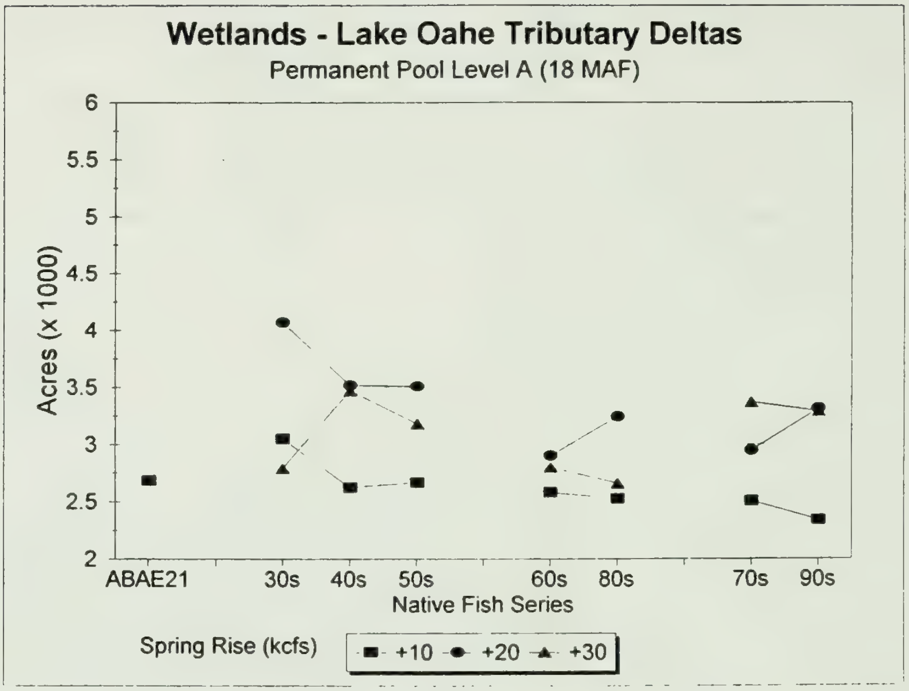

Figure 4-103. Average annual wetland acreage in Lake Oahe tributary deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

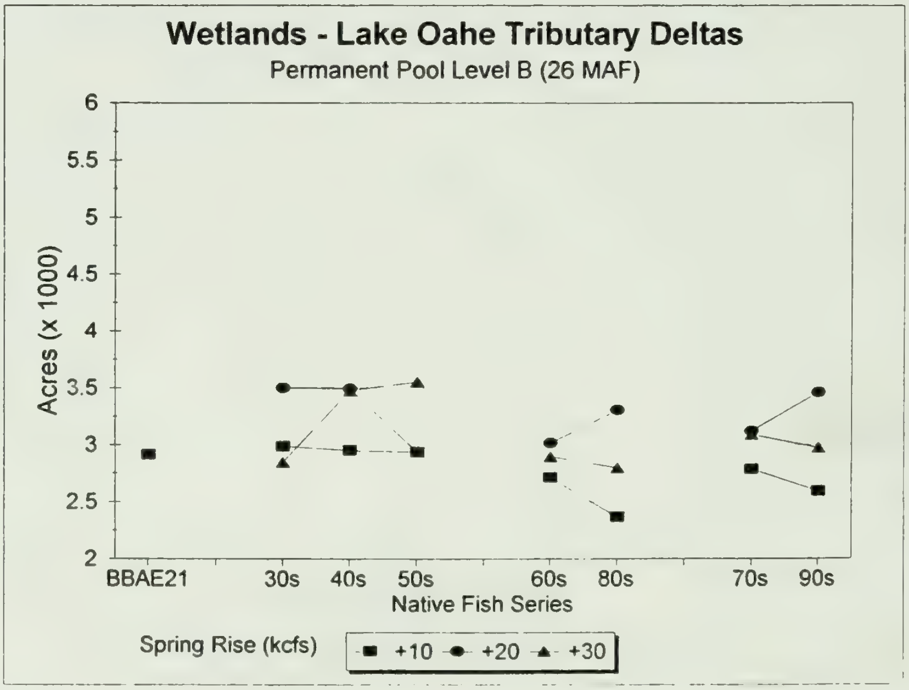

Figure 4-104. Average annual wetland acreage in Lake Oahe tributary deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

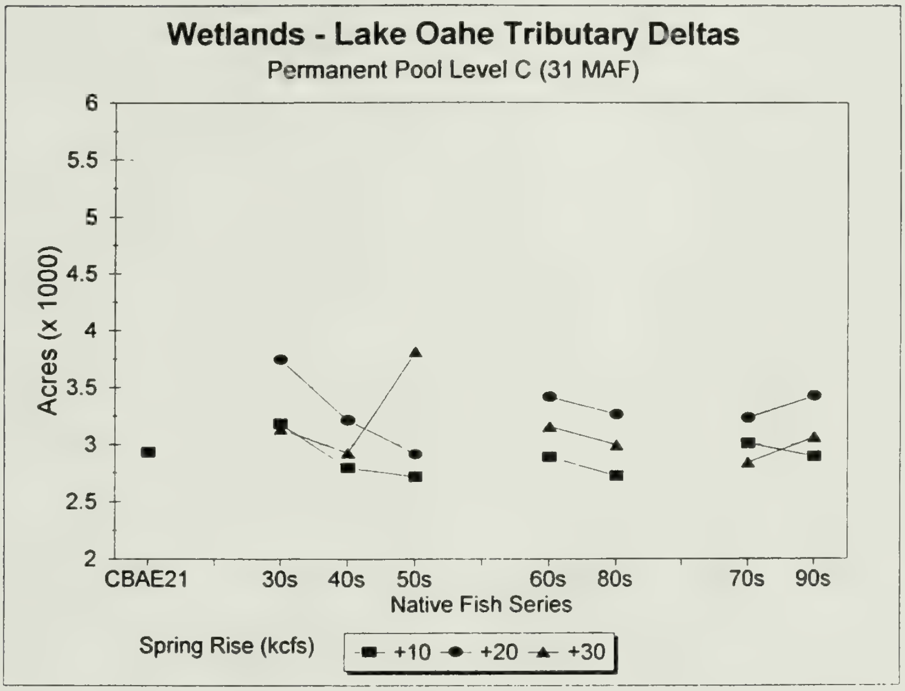

Figure 4-105. Average annual wetland acreage in Lake Oahe tributary deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

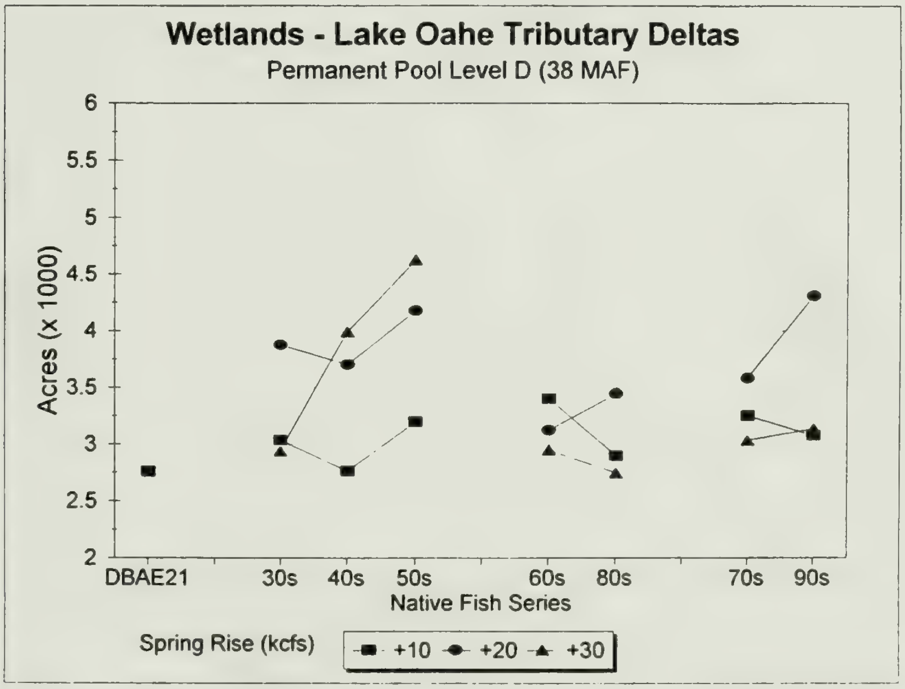

Figure 4-106. Average annual wetland acreage in Lake Oahe tributary deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

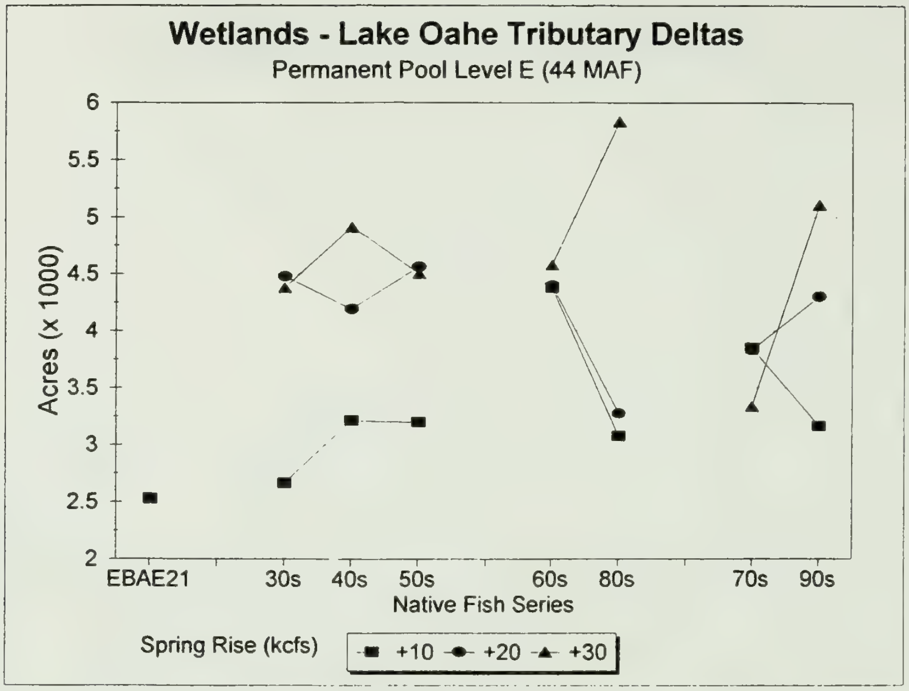

Figure 4-107. Average annual wetland acreage in Lake Oahe tributary deltas over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

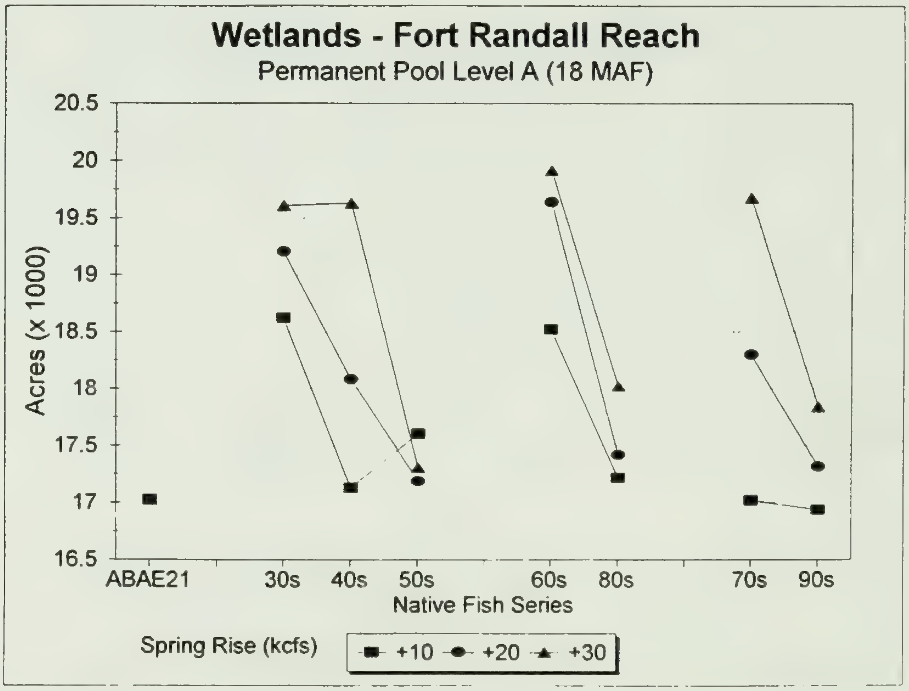

Figure 4-108. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

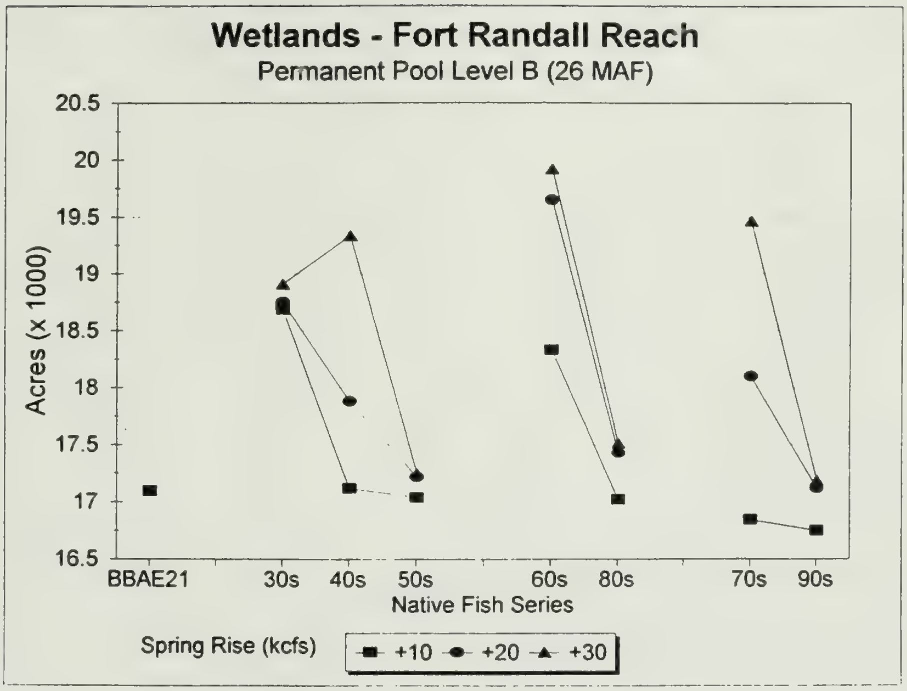

Figure 4-109. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

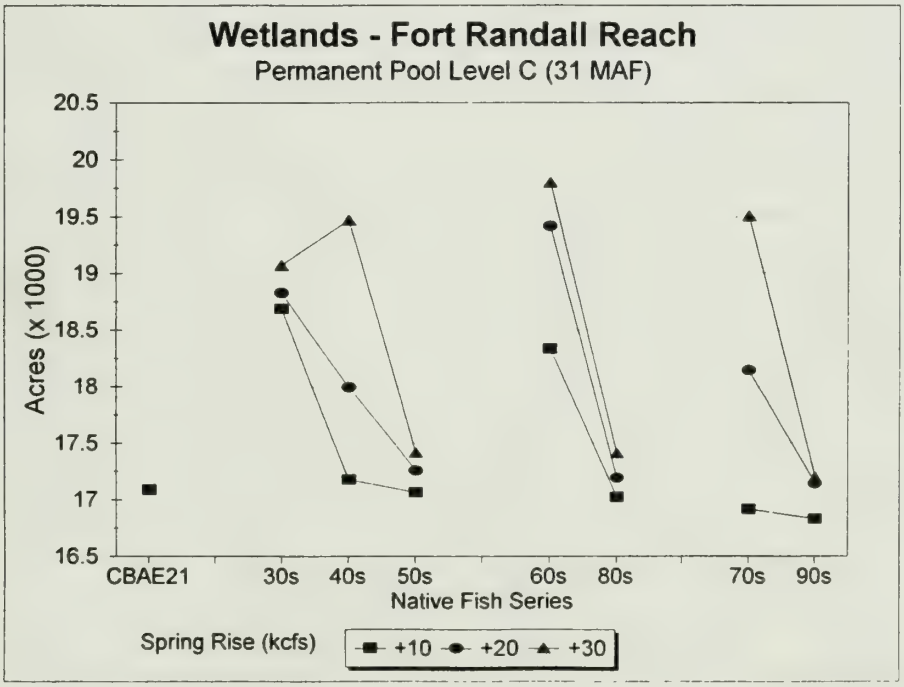

Figure 4-110. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

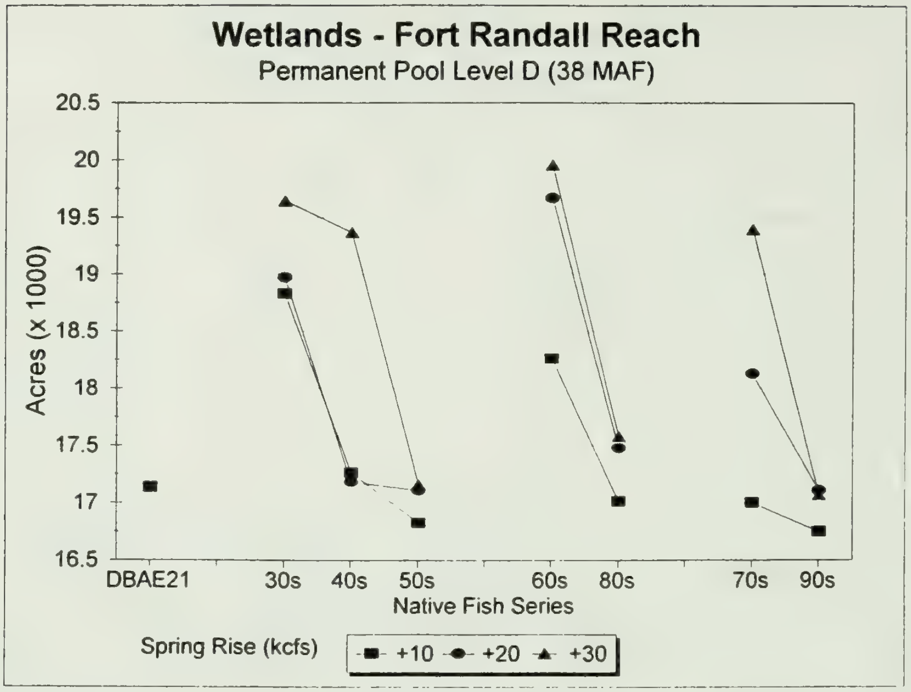

Figure 4-111. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

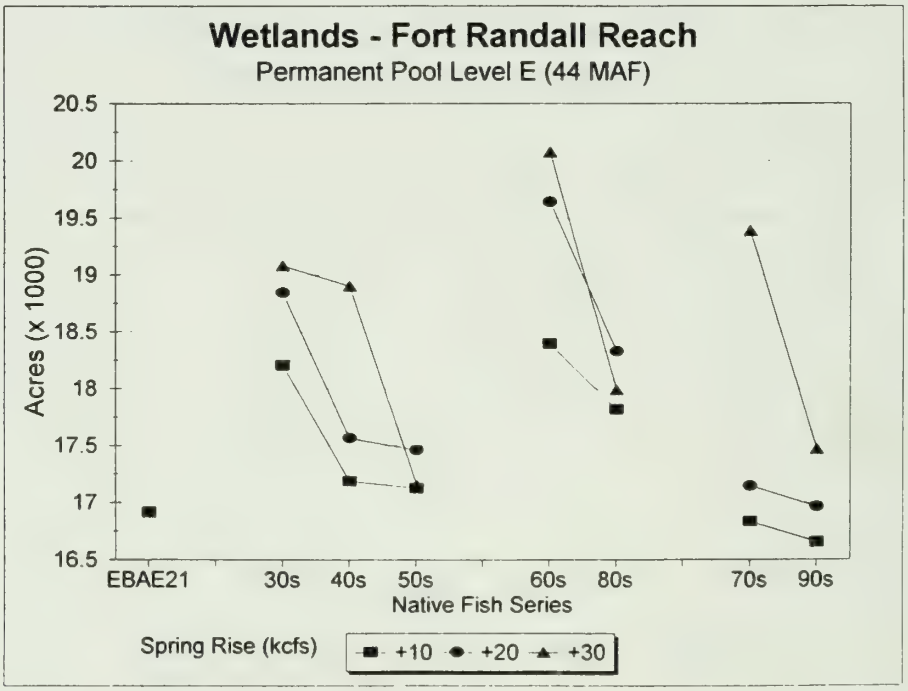

Figure 4-112. Average annual wetland acreage in Fort Randall reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

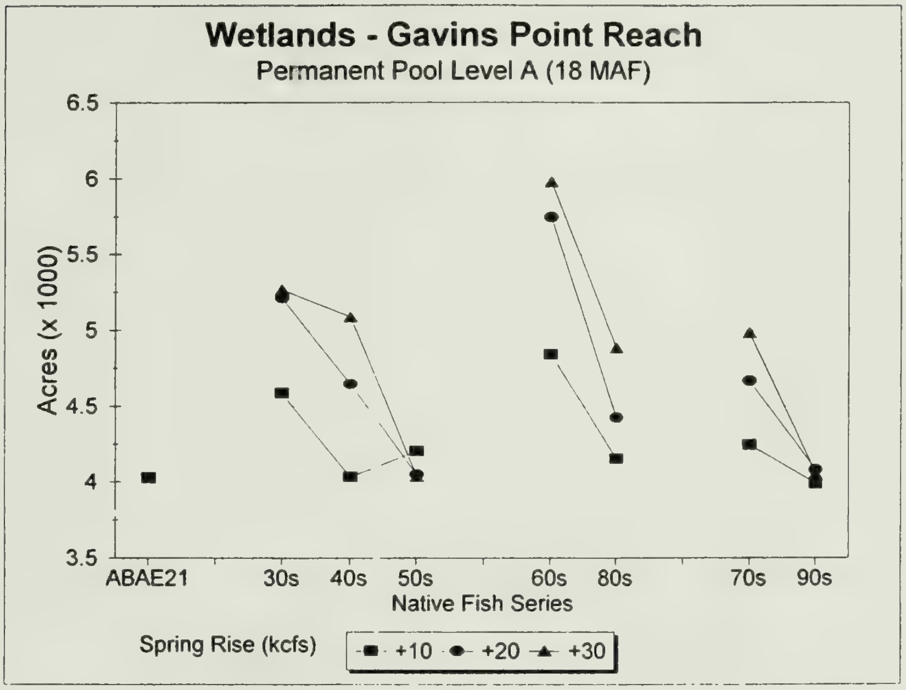

Figure 4-113. Average annual wetland acreage in Gavins Point reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

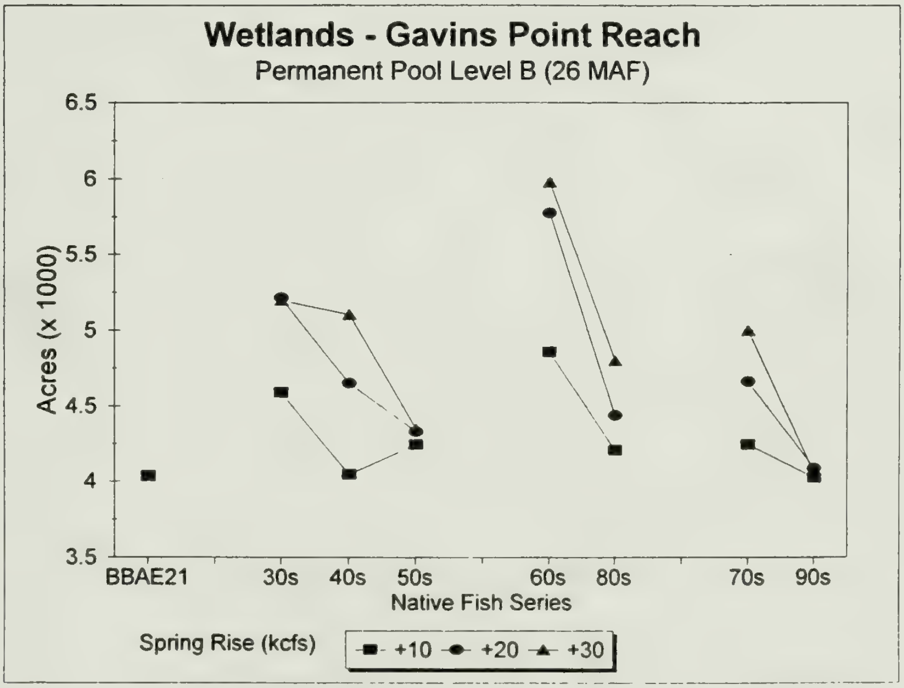

Figure 4-114. Average annual wetland acreage in Gavins Point reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

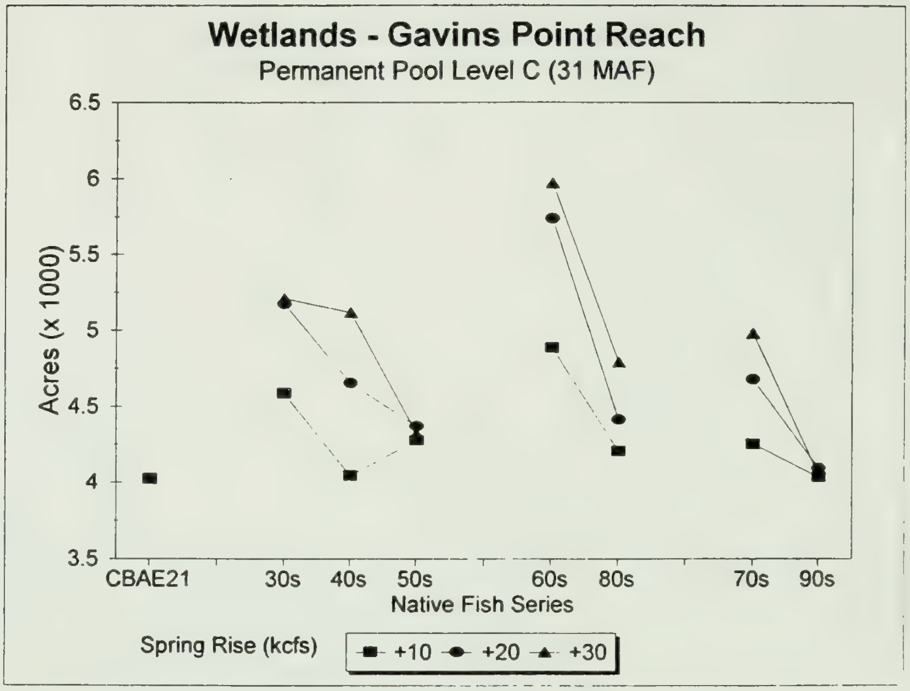

Figure 4-115. Average annual wetland acreage in Gavins Point reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

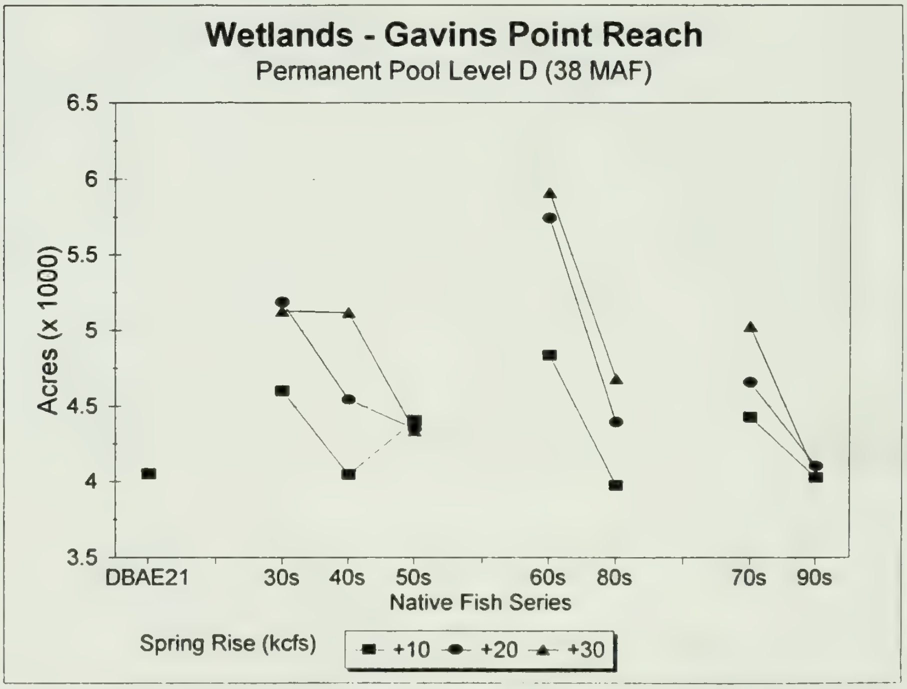

Figure 4-116. Average annual wetland acreage in Gavins Point reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

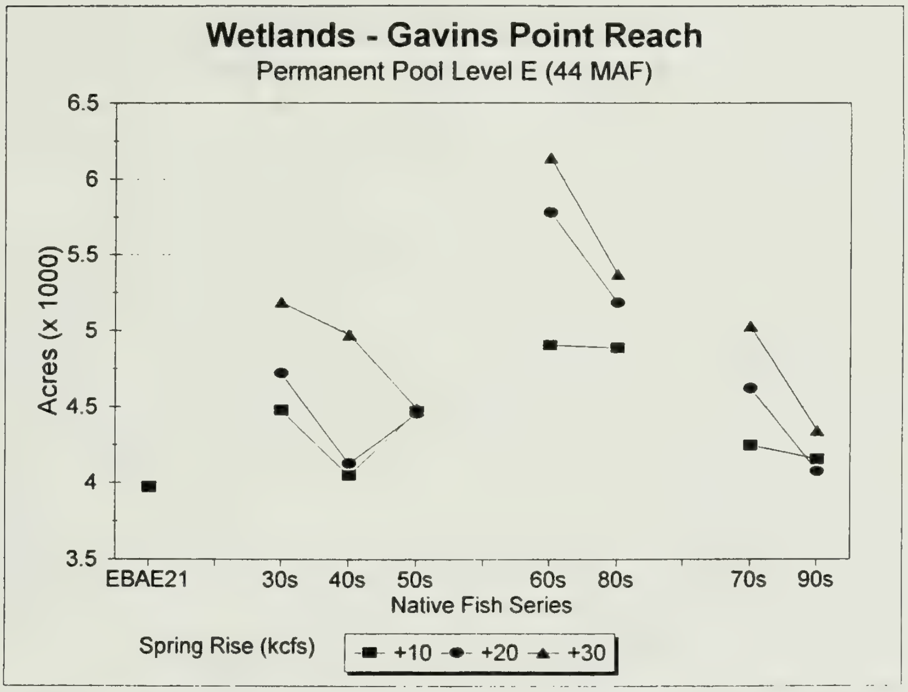

Figure 4-117. Average annual wetland acreage in Gavins Point reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

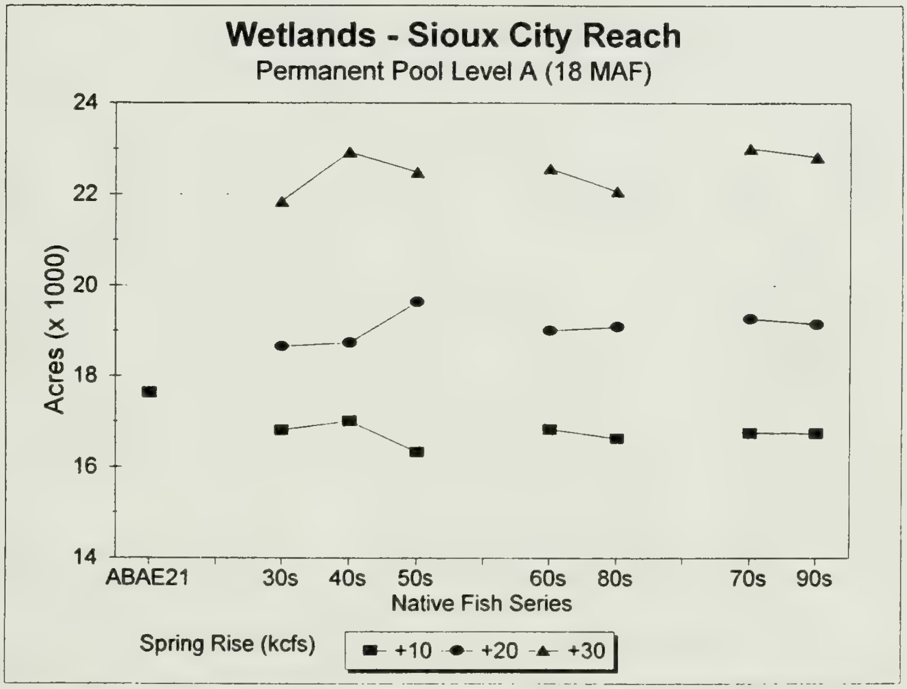

Figure 4-118. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

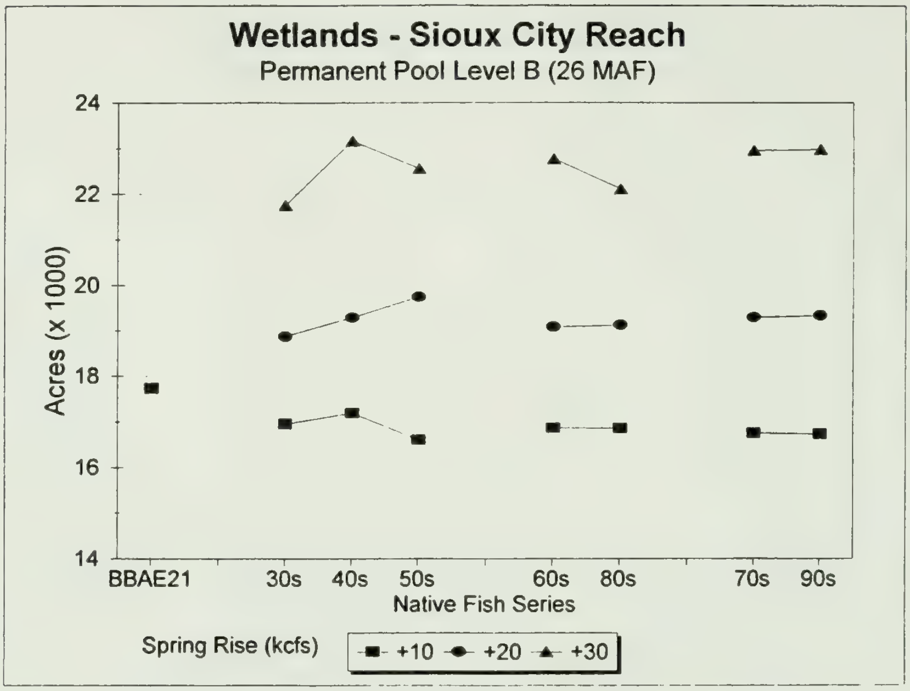

Figure 4-119. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

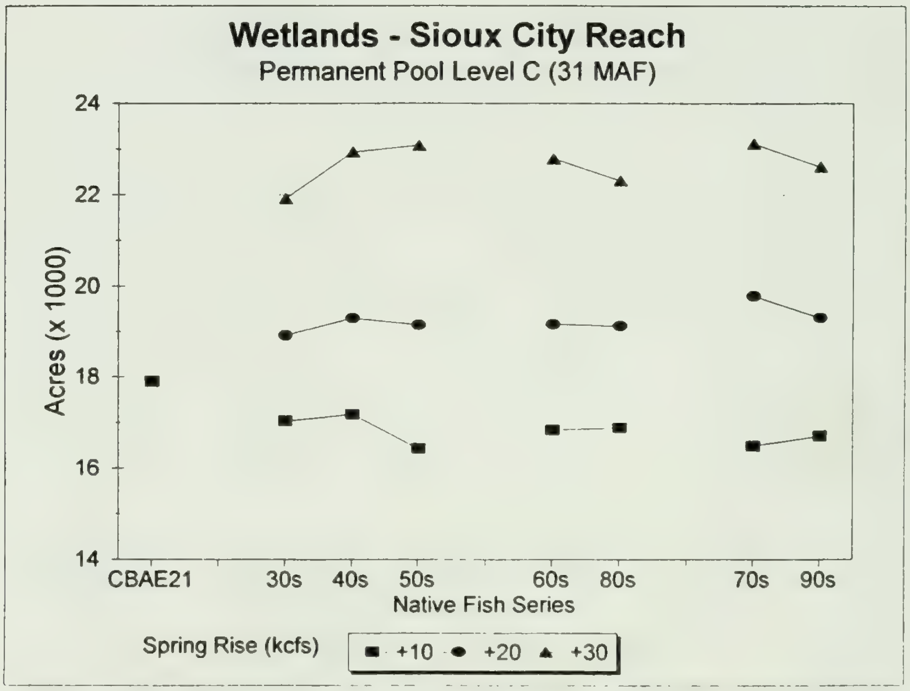

Figure 4-120. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

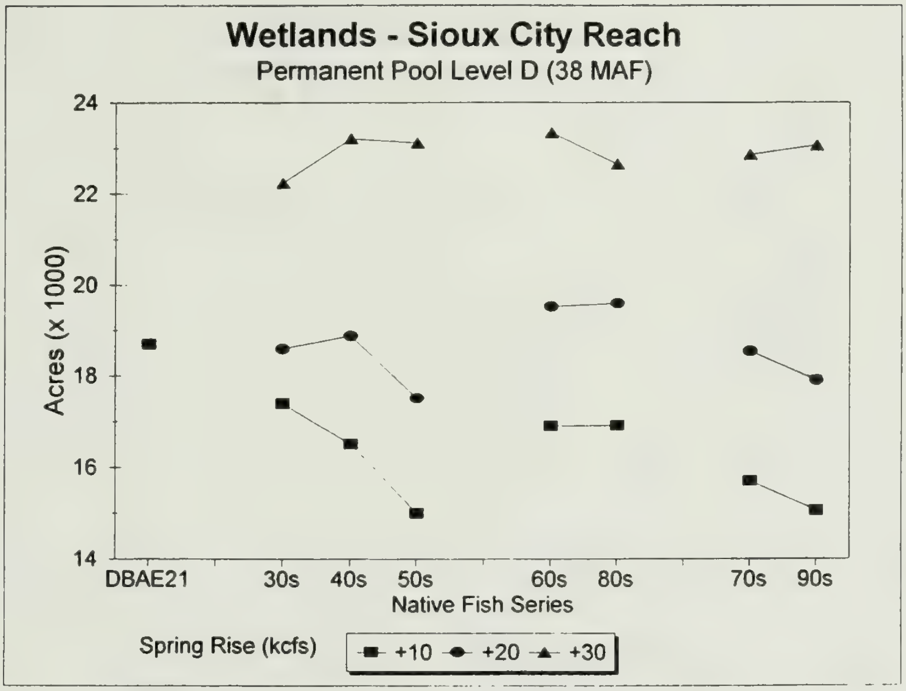

Figure 4-121. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

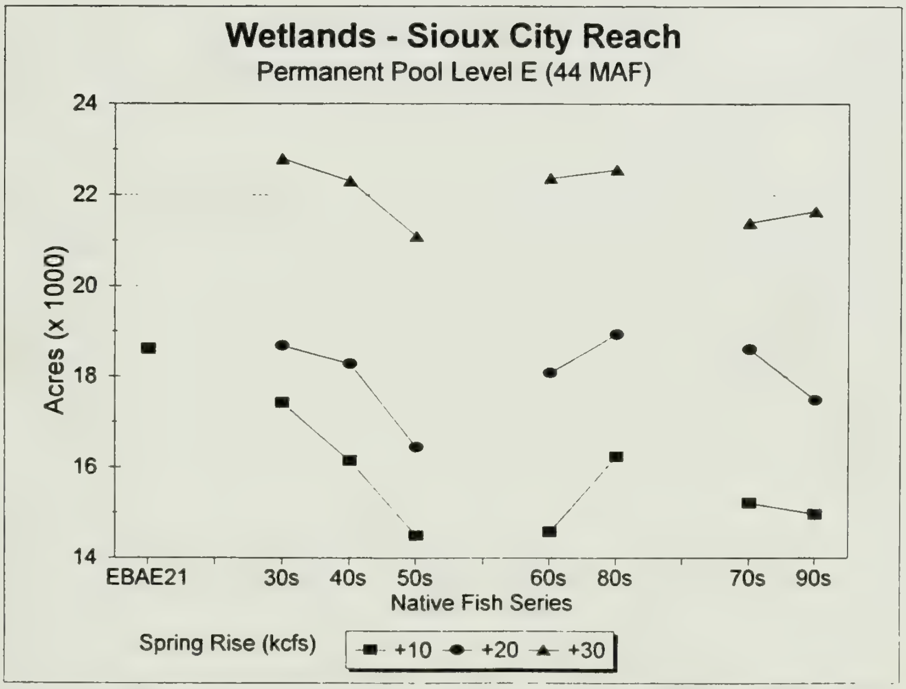

Figure 4-122. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

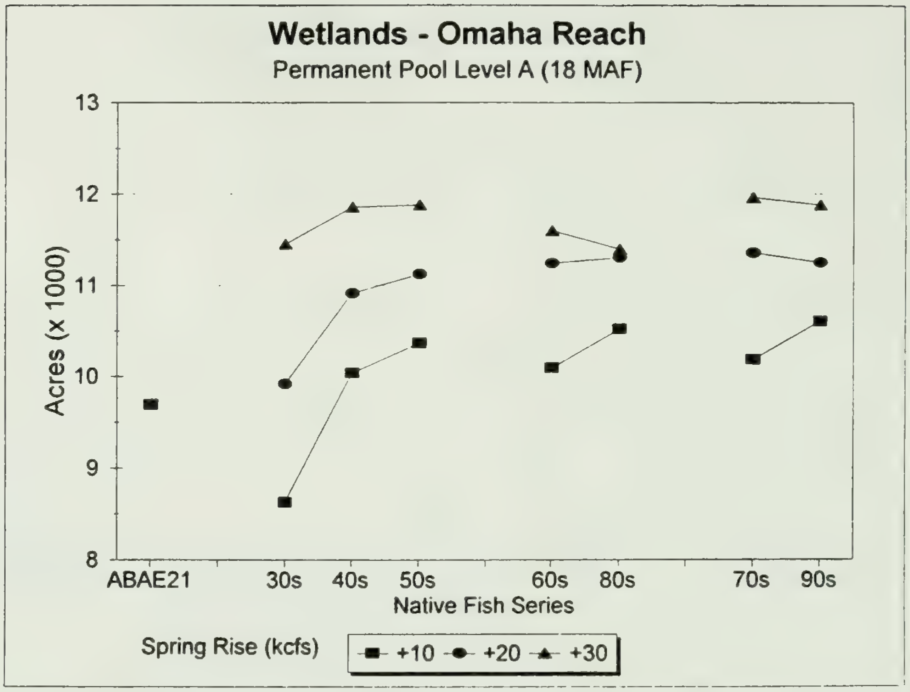

Figure 4-123. Average annual wetland acreage in Omaha reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

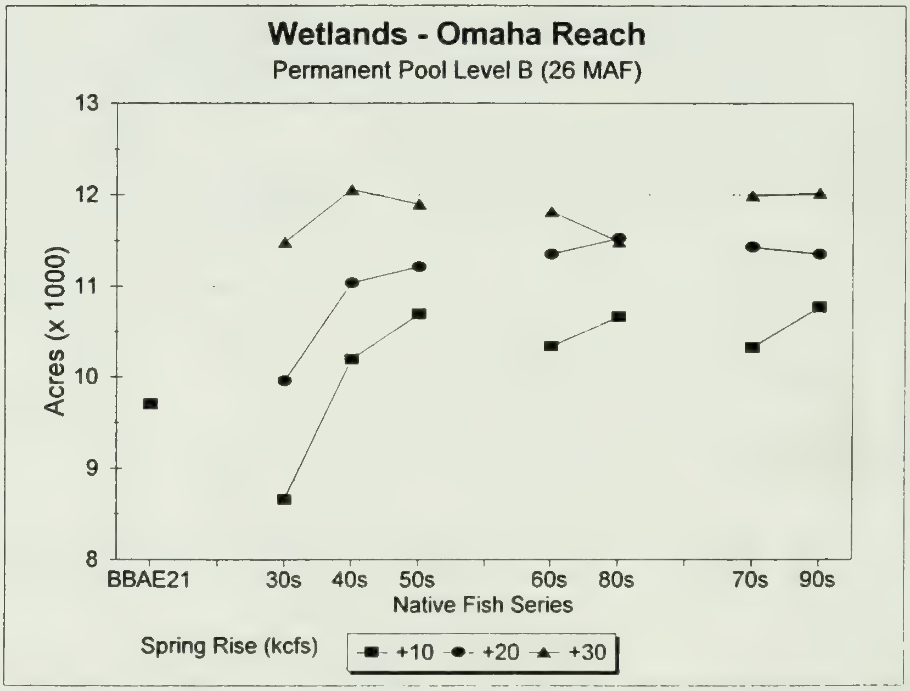

Figure 4-124. Average annual wetland acreage in Omaha reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

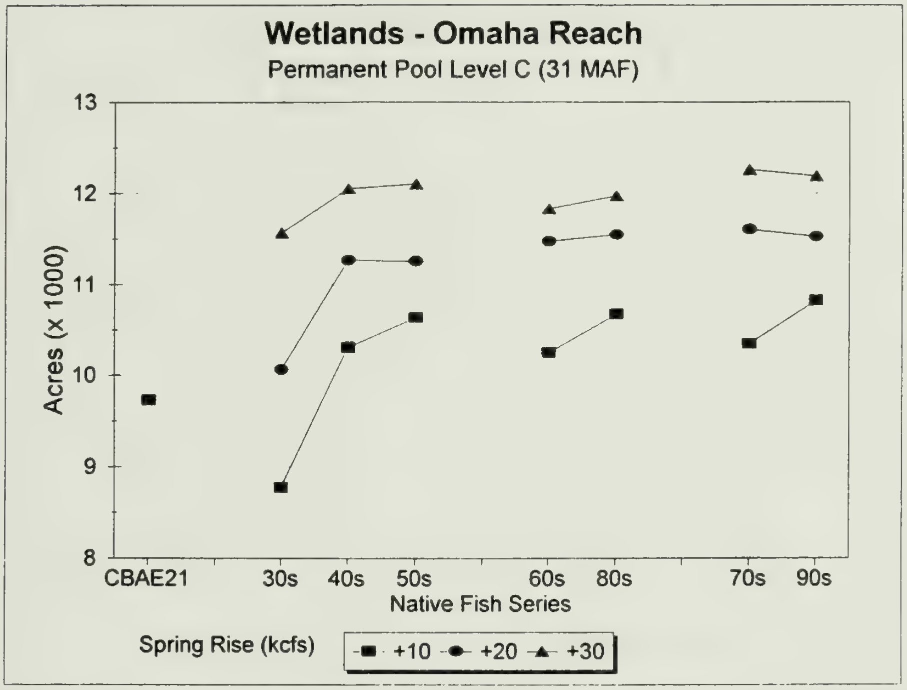

Figure 4-125. Average annual wetland acreage in Omaha reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

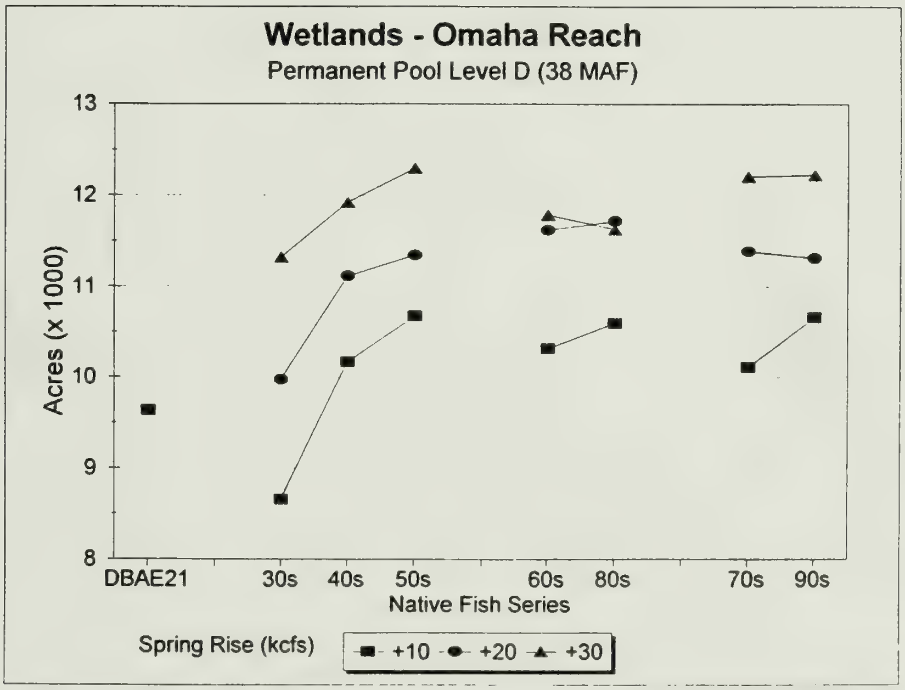

Figure 4-126. Average annual wetland acreage in Omaha reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

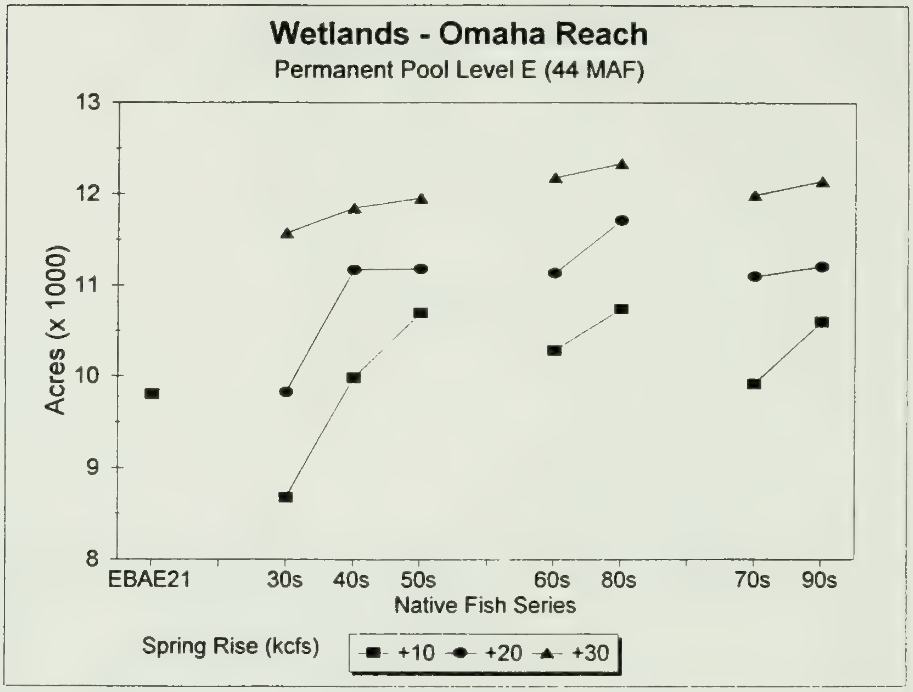

Figure 4-127. Average annual wetland acreage in Omaha reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

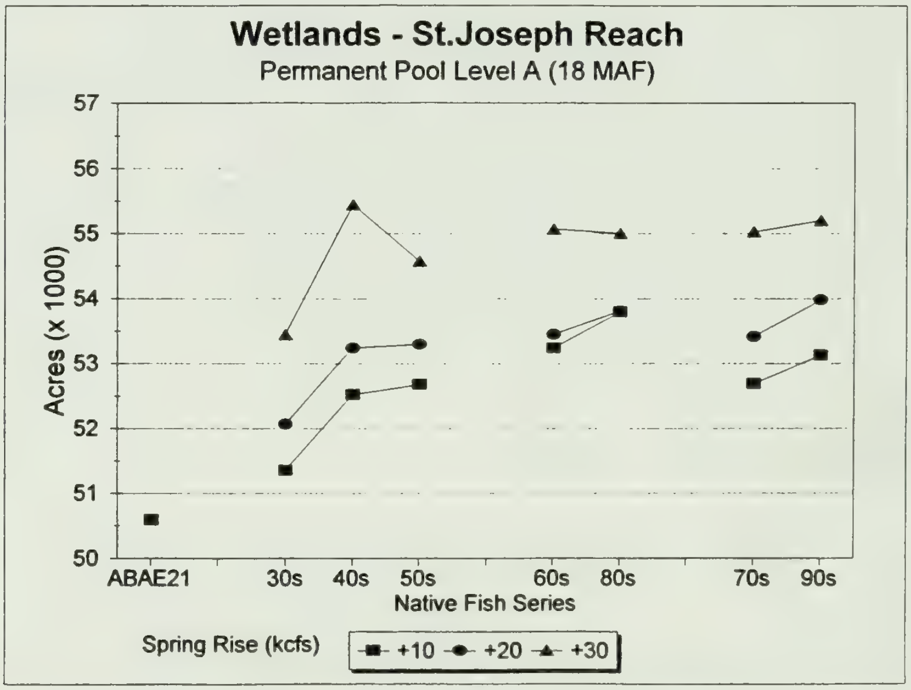

Figure 4-128. Average annual wetland acreage in St. Joseph reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 18 MAF.

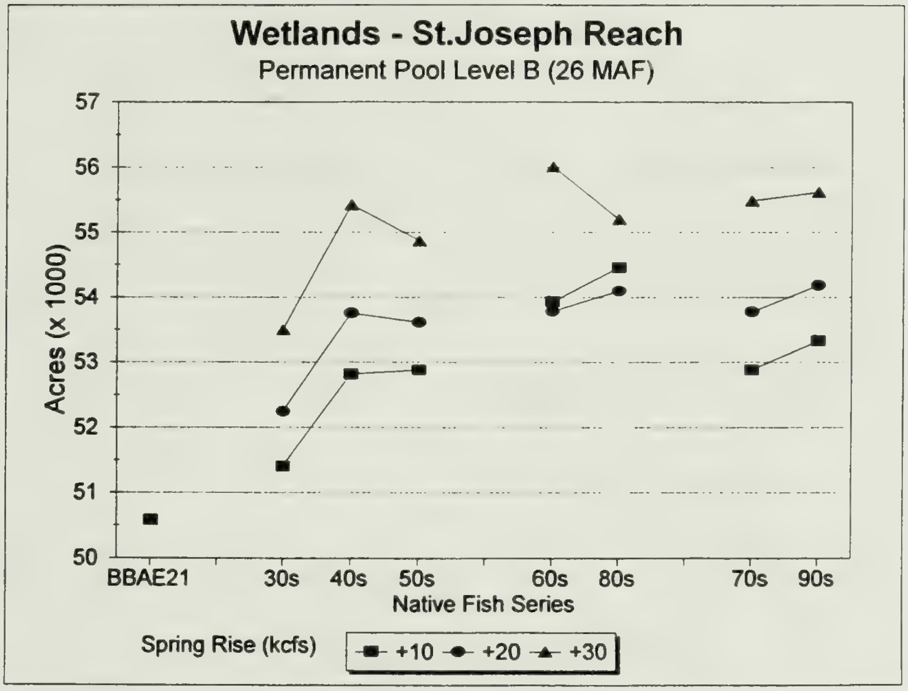

Figure 4-129. Average annual wetland acreage in St. Joseph reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 26 MAF.

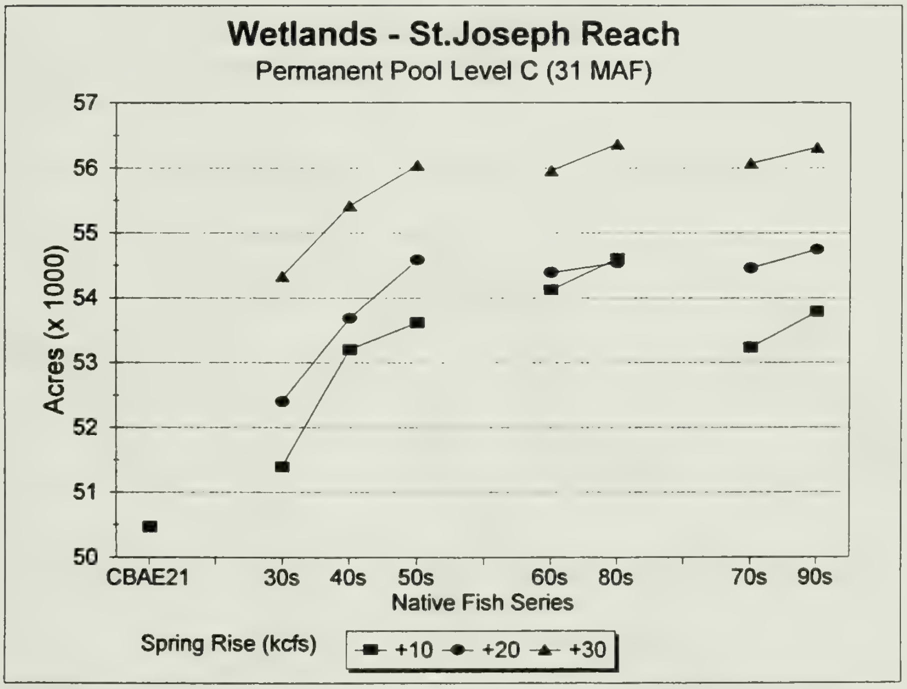

Figure 4-130. Average annual wetland acreage in St. Joseph reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 31 MAF.

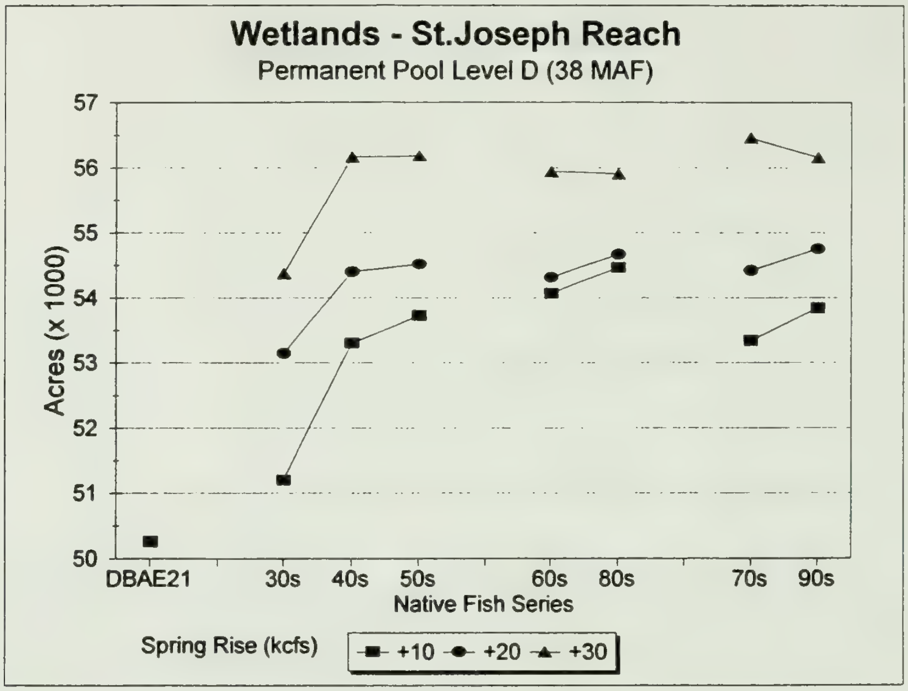

Figure 4-131. Average annual wetland acreage in St. Joseph reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 38 MAF.

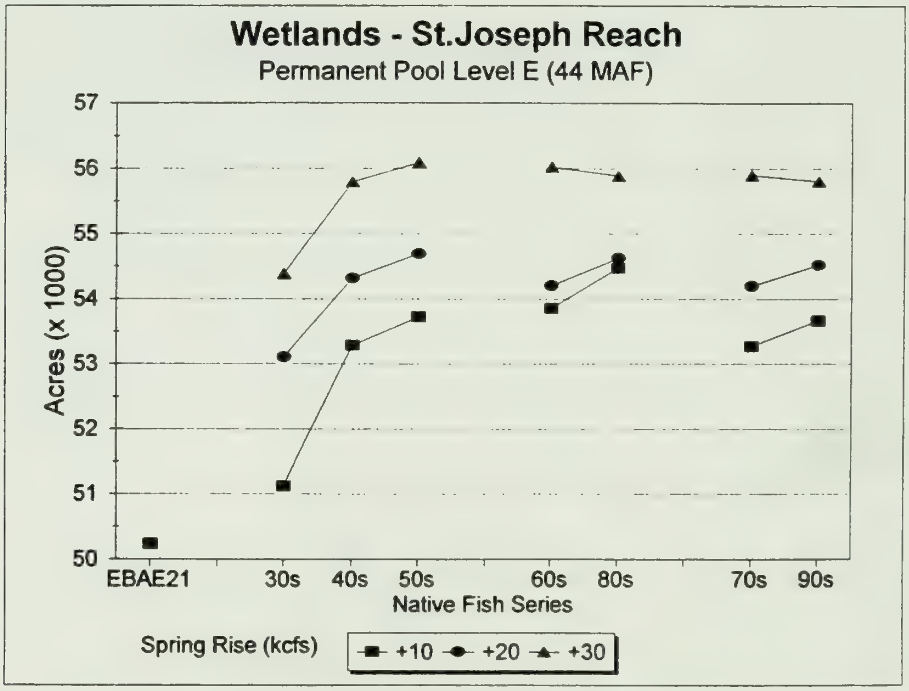

Figure 4-132. Average annual wetland acreage in St. Joseph reach over the 96-year simulation period for Native Fish alternatives with permanent pool level of 44 MAF.

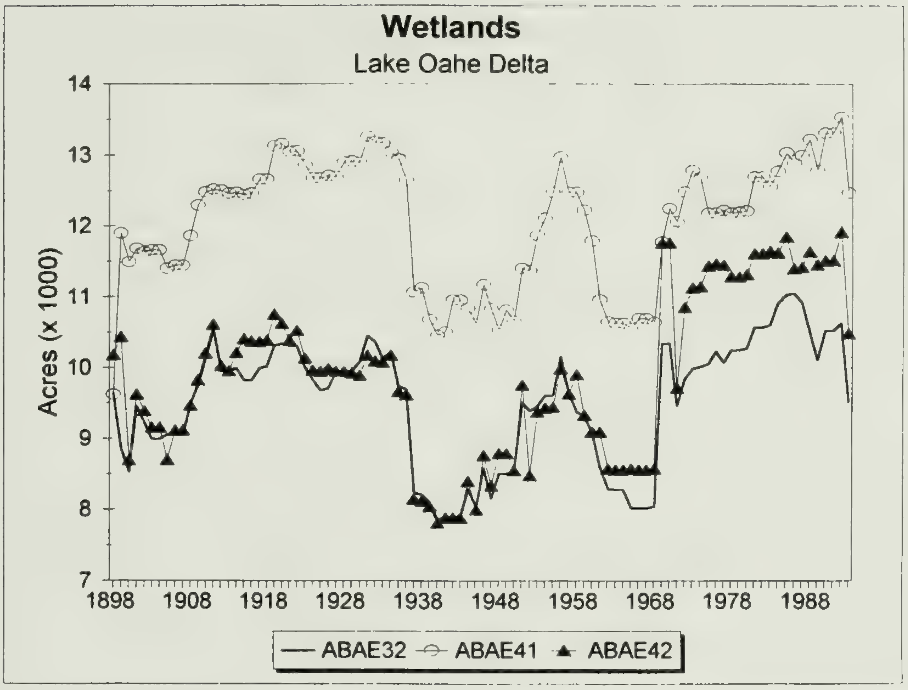

Figure 4-133. Average annual wetland acreage in Lake Oahe delta over the 96-year simulation period for alternatives ABAE21, ABAE42, and ABAE32.

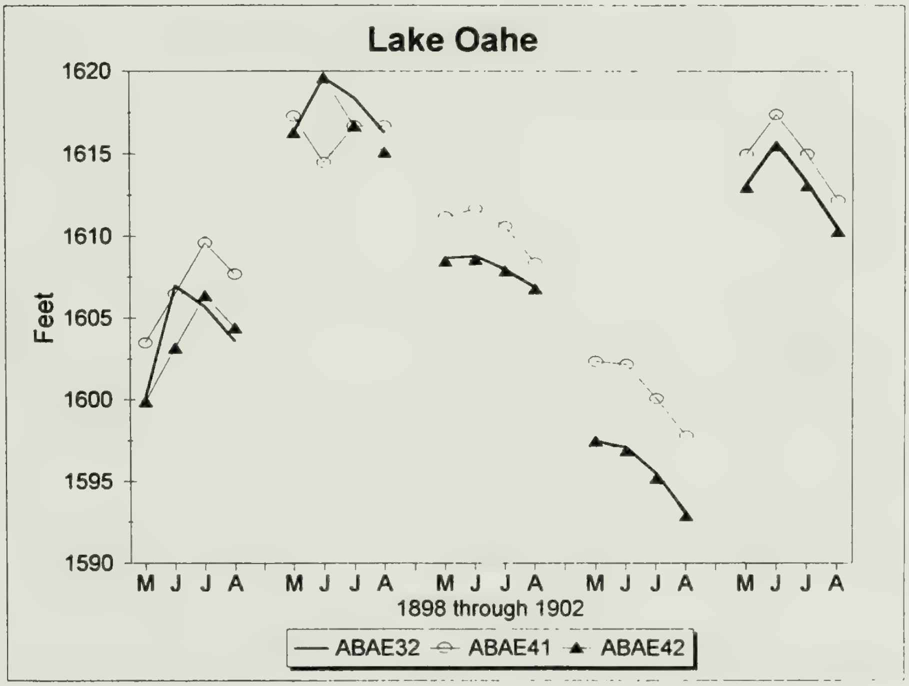

Figure 4-134. Average monthly water levels in Lake Oahe for May, June, July, and August from 1898 to 1902 for alternatives ABAE41, ABAE42, and ABAE32.

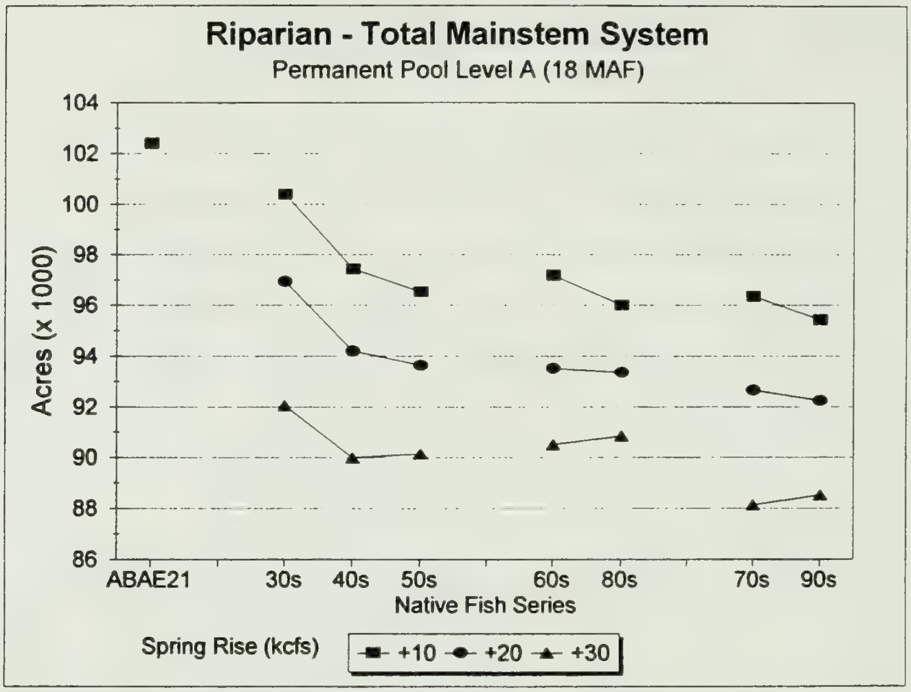

Figure 4-135. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 18 MAF.

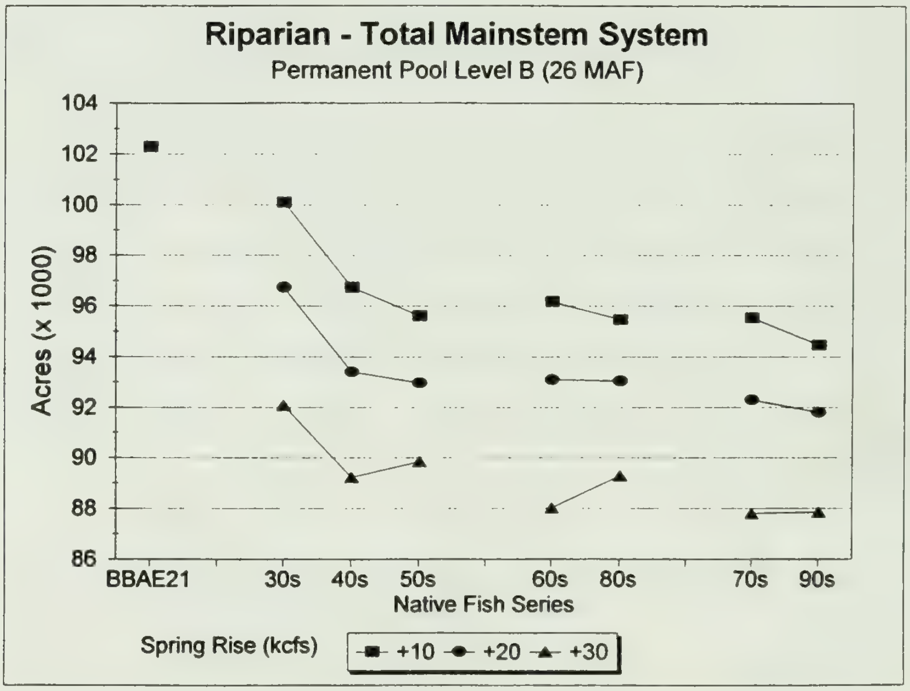

Figure 4-136. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 26 MAF.

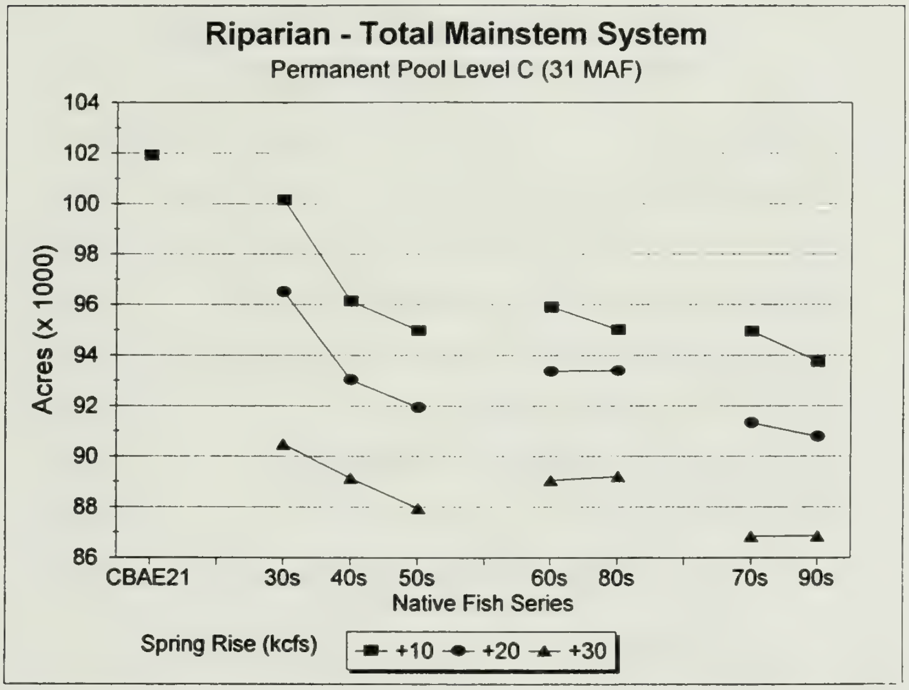

Figure 4-137. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 31 MAF.

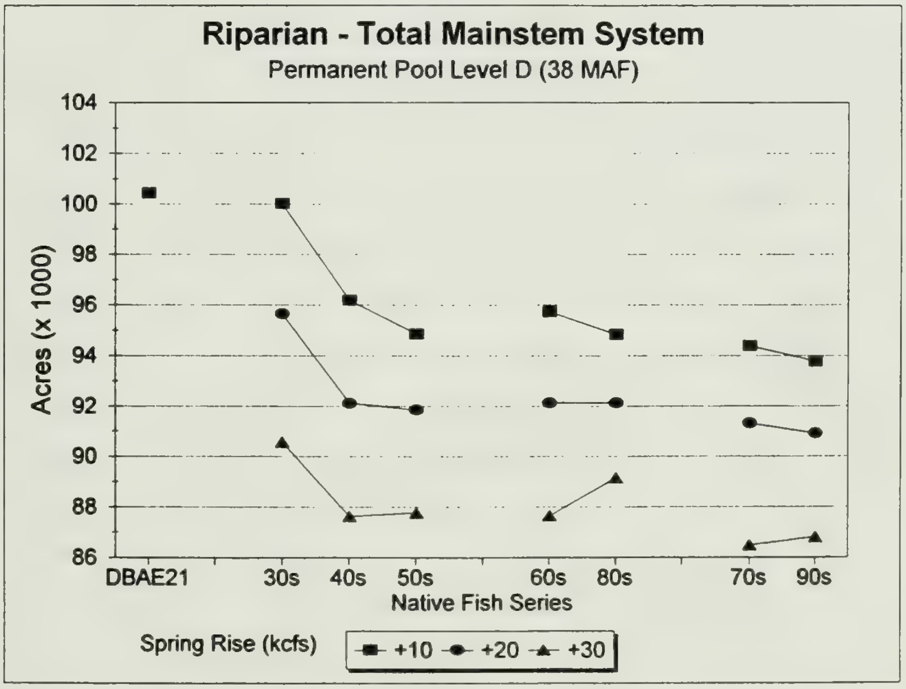

Figure 4-138. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 38 MAF.

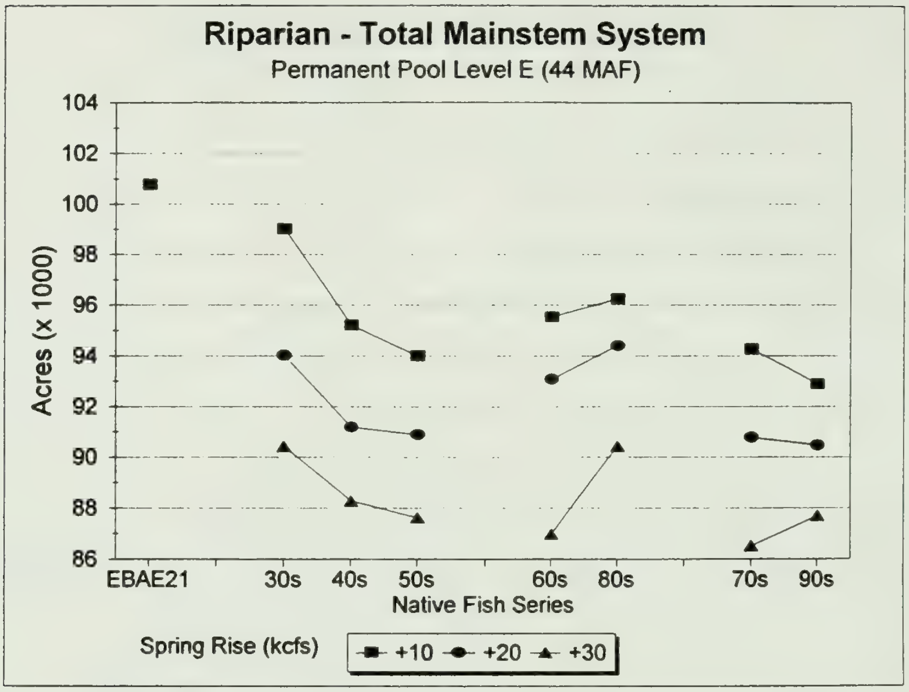

Figure 4-139. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 44 MAF.

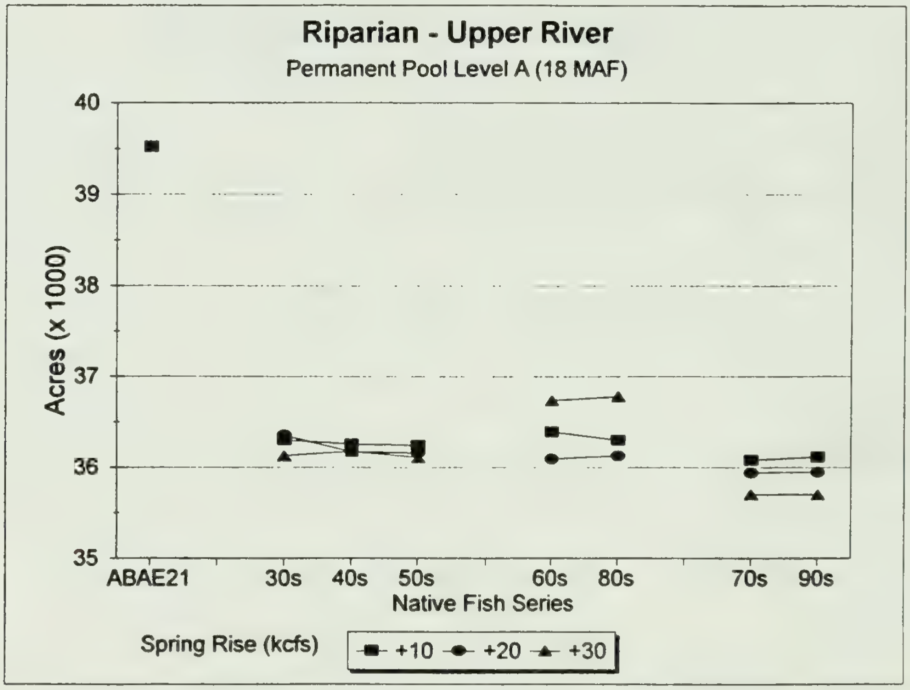

Figure 4-140. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 18 MAF.

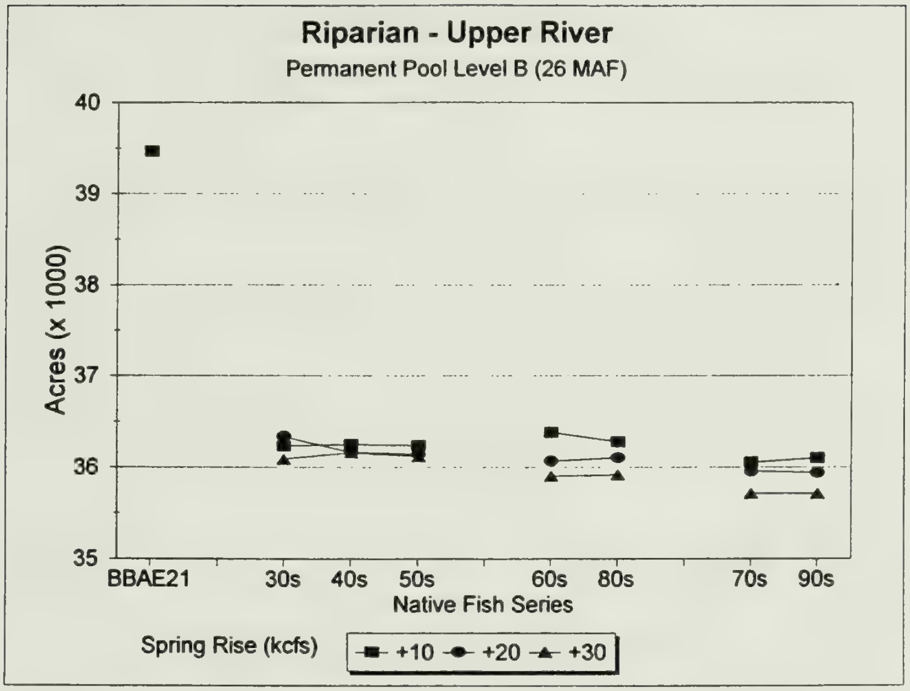

Figure 4-141. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 26 MAF.

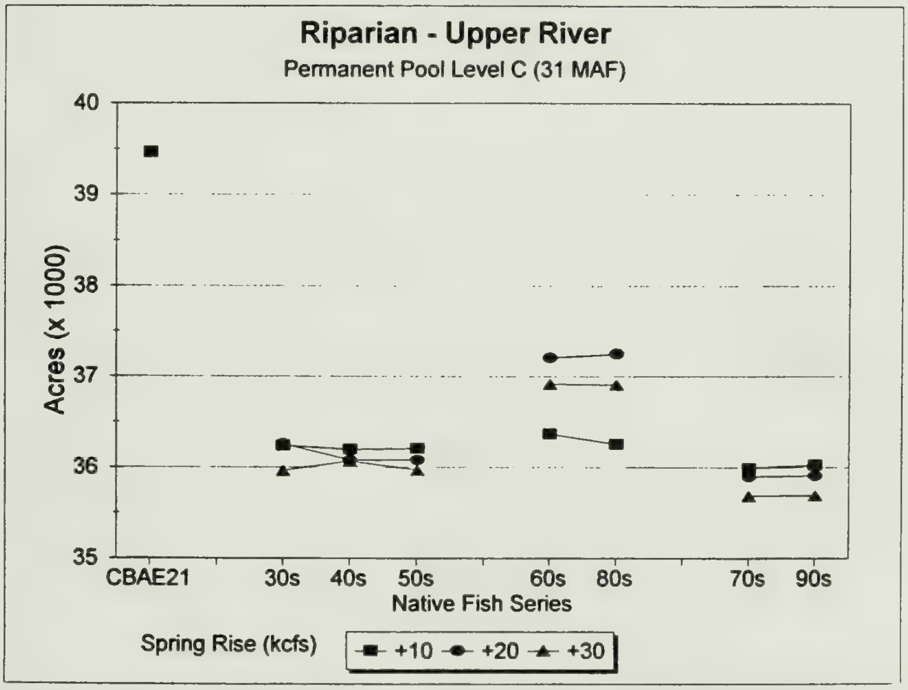

Figure 4-142. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 31 MAF.

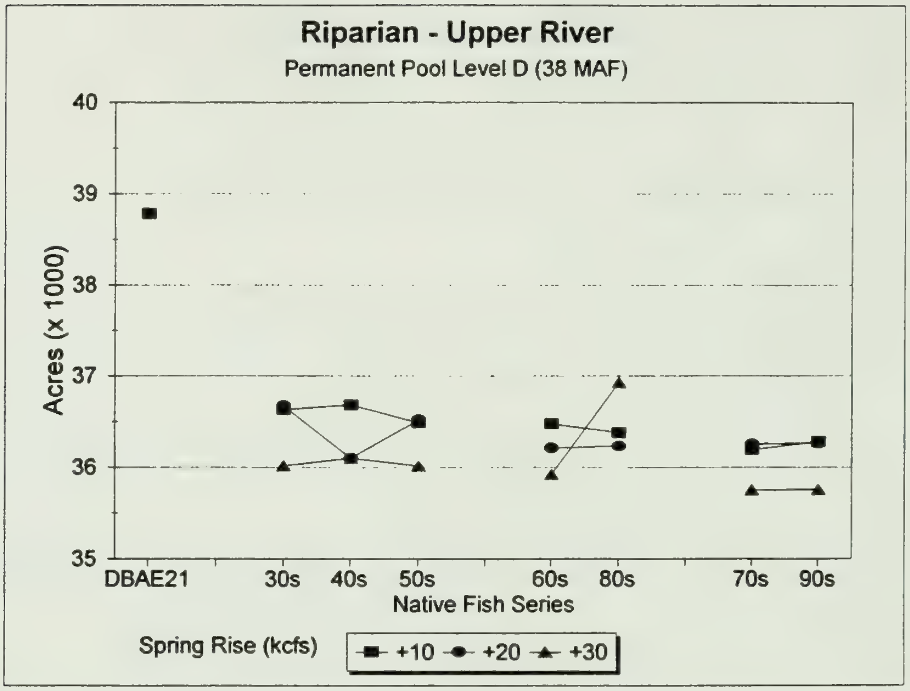

Figure 4-143. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 38 MAF.

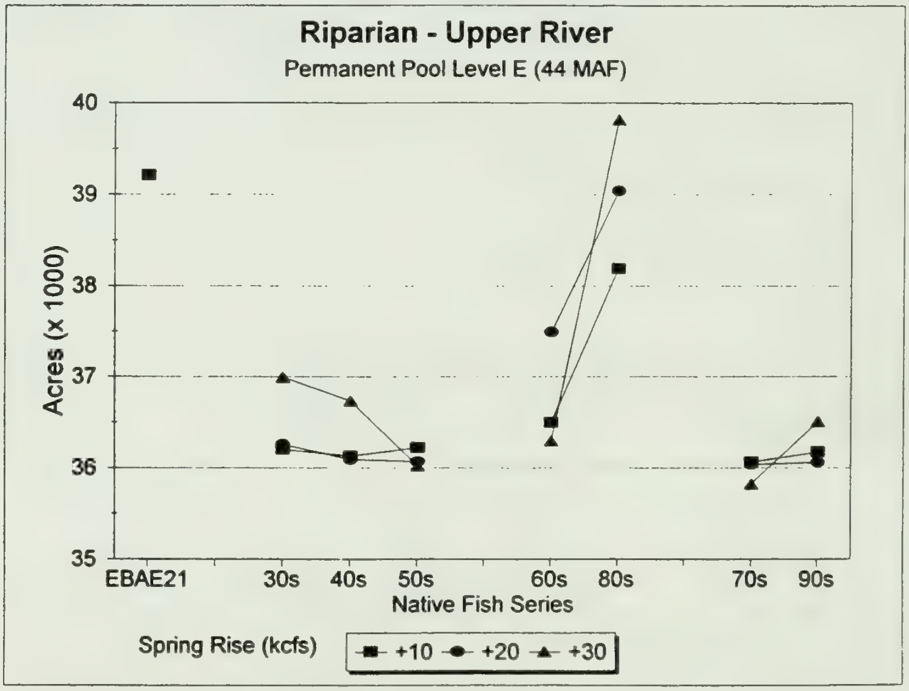

Figure 4-144. Average annual acreage of woody riparian vegetation in upper river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 44 MAF.

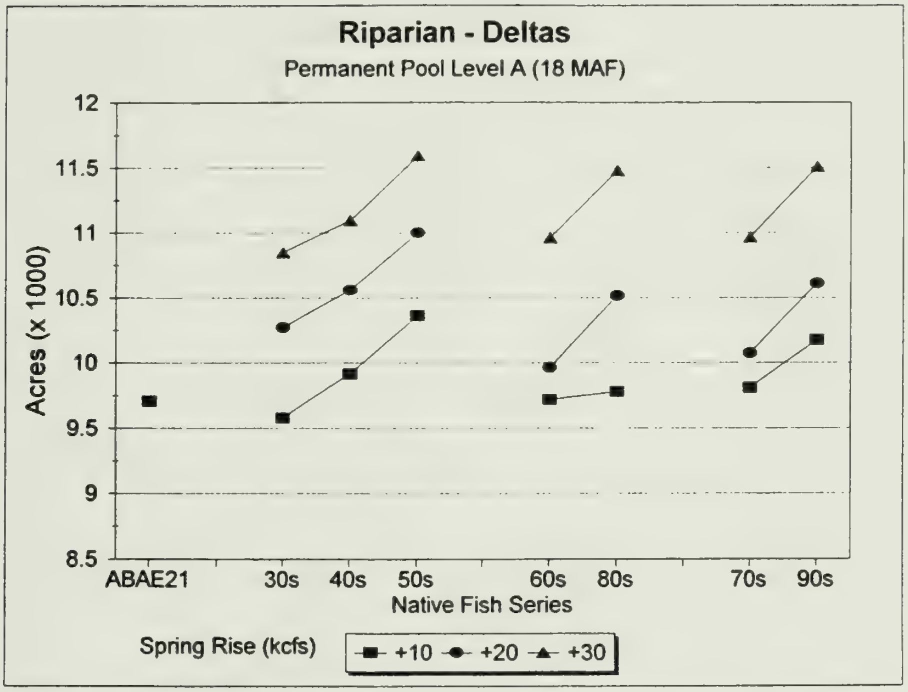

Figure 4-145. Average annual acreage of woody riparian vegetation in mainstem lake deltas over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 18 MAF.

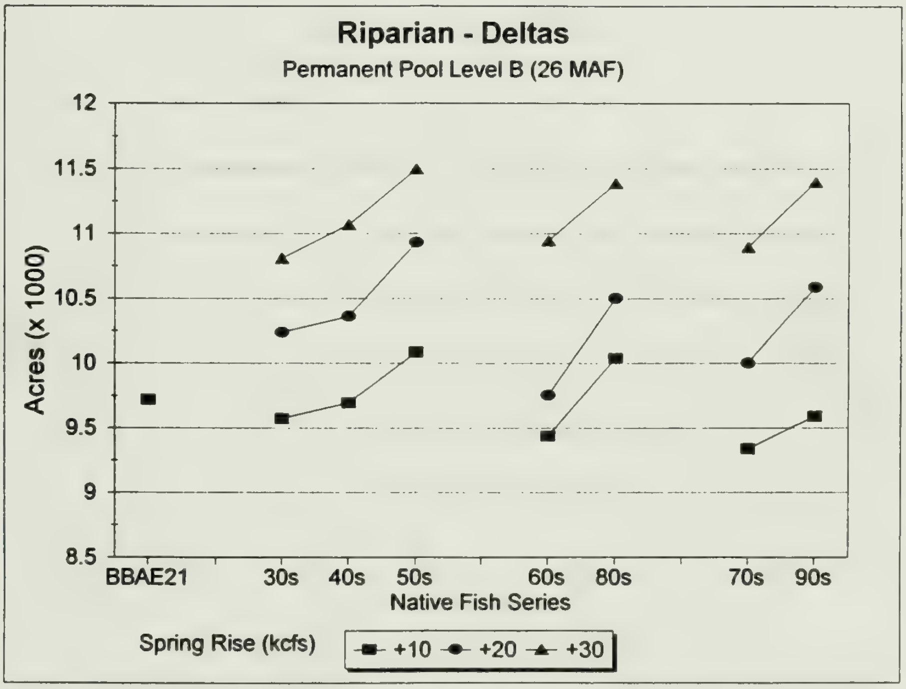

Figure 4-146. Average annual acreage of woody riparian vegetation in mainstem lake deltas over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 26 MAF.

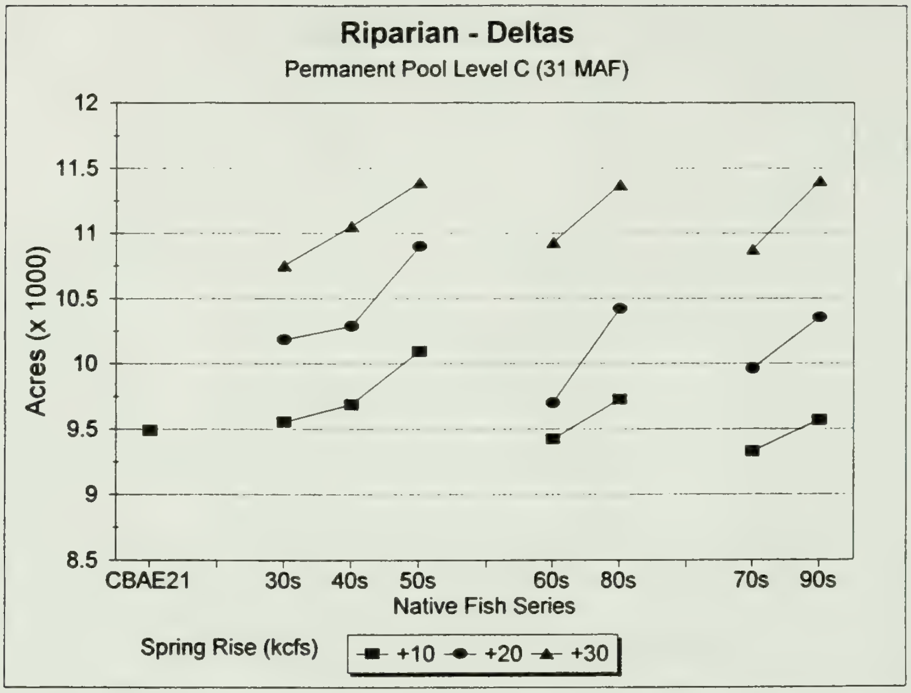

Figure 4-147. Average annual acreage of woody riparian vegetation in mainstem lake deltas over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 31 MAF.

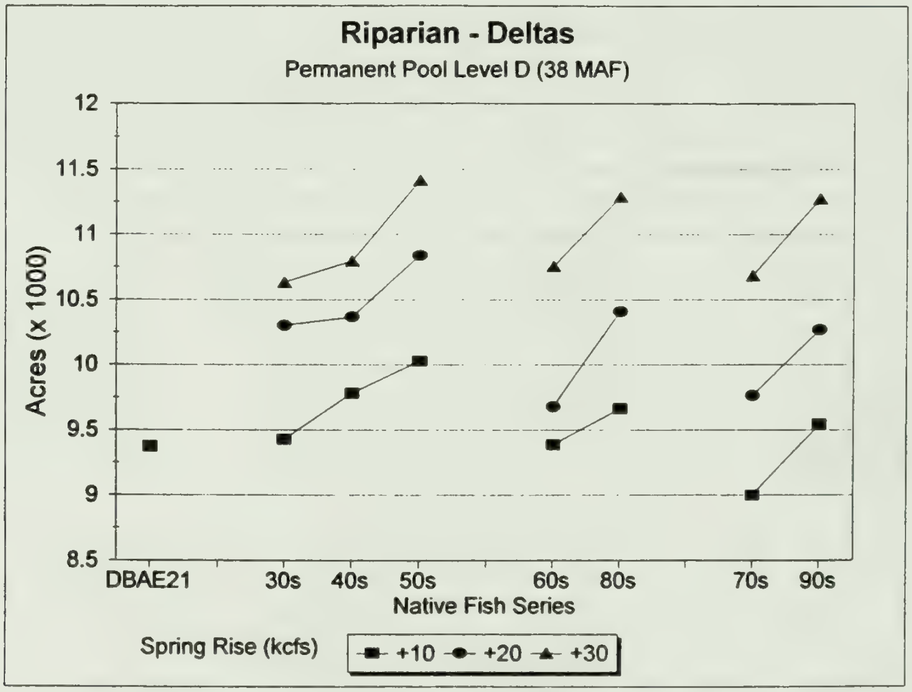

Figure 4-148. Average annual acreage of woody riparian vegetation in mainstem lake deltas over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 38 MAF.

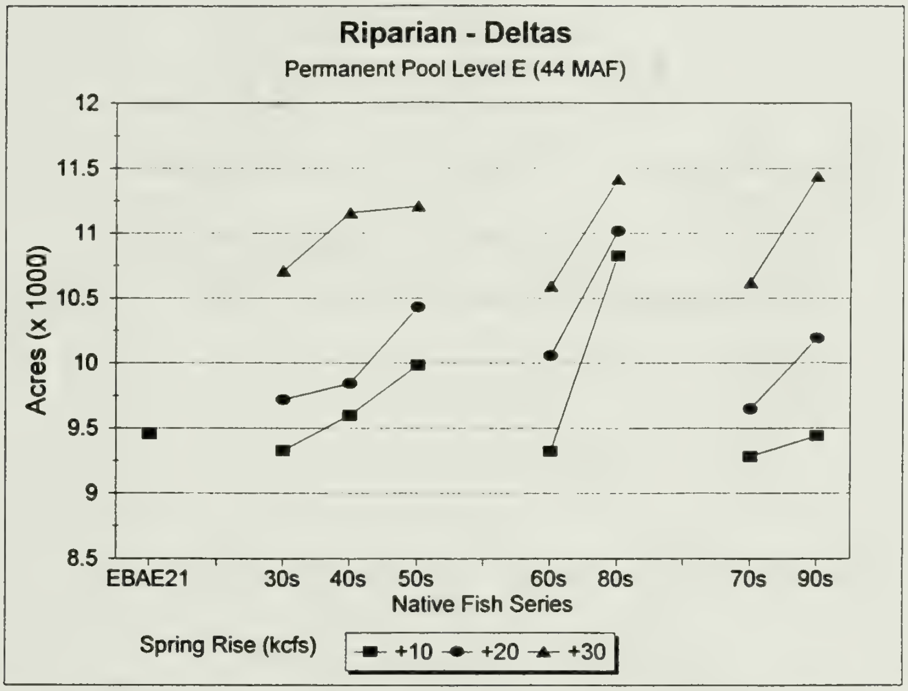

Figure 4-149. Average annual acreage of woody riparian vegetation in mainstem lake deltas over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 44 MAF.

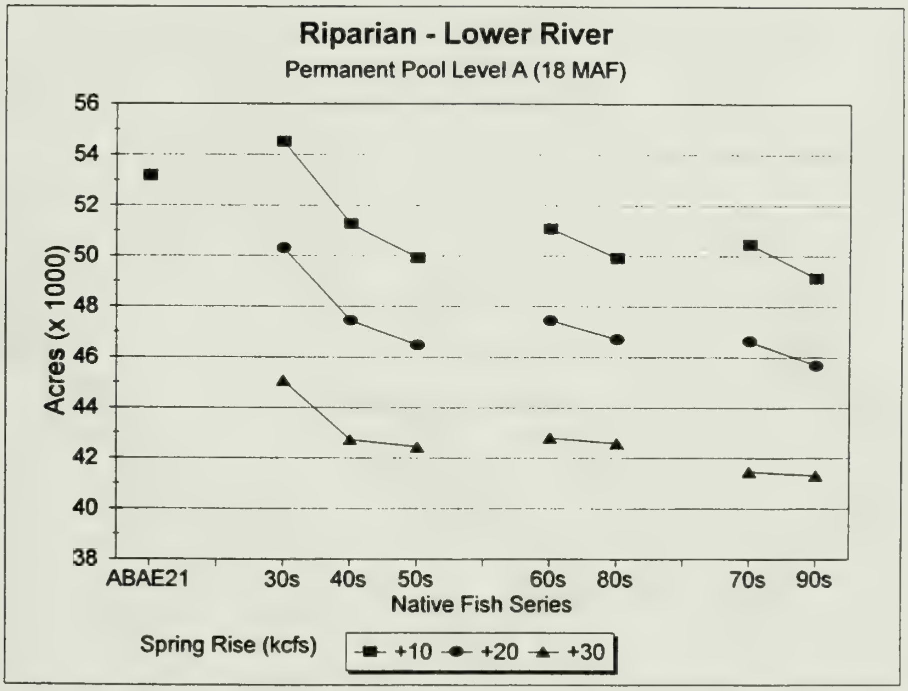

Figure 4-150. Average annual acreage of woody riparian vegetation in lower river sections of the mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 18 MAF.

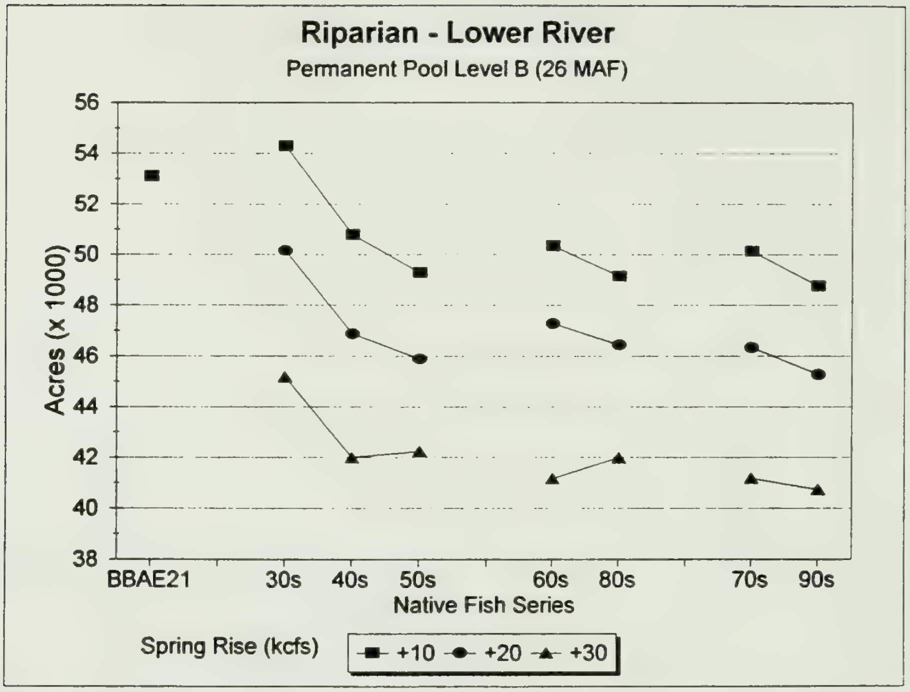

Figure 4-151. Average annual acreage of woody riparian vegetation in lower river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 26 MAF.

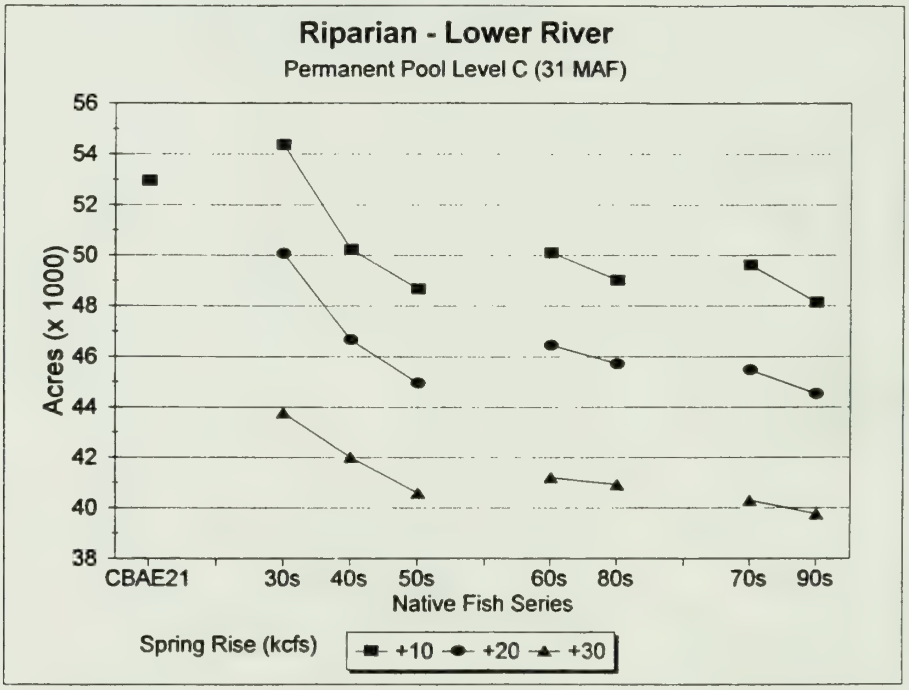

Figure 4-152. Average annual acreage of woody riparian vegetation in lower river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 31 MAF.

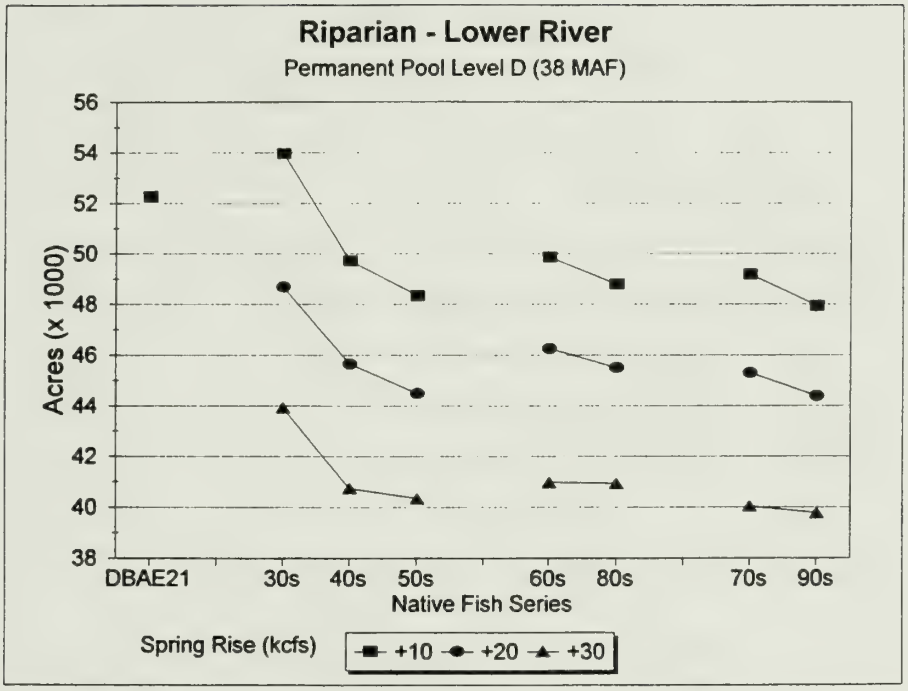

Figure 4-153. Average annual acreage of woody riparian vegetation in lower river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 38 MAF.

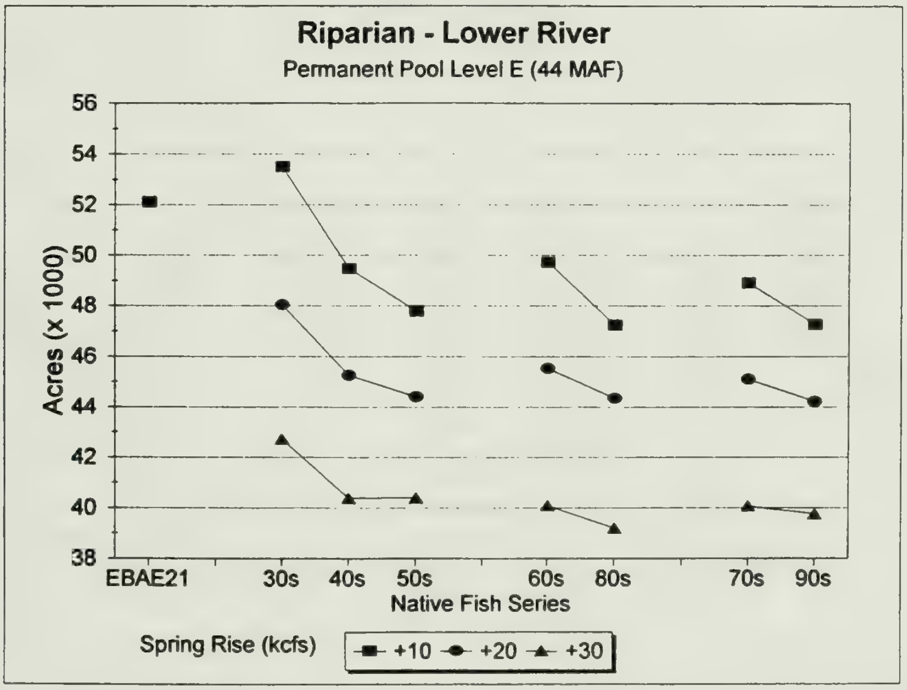

Figure 4-154. Average annual acreage of woody riparian vegetation in lower river sections of the Mainstem System over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 44 MAF.

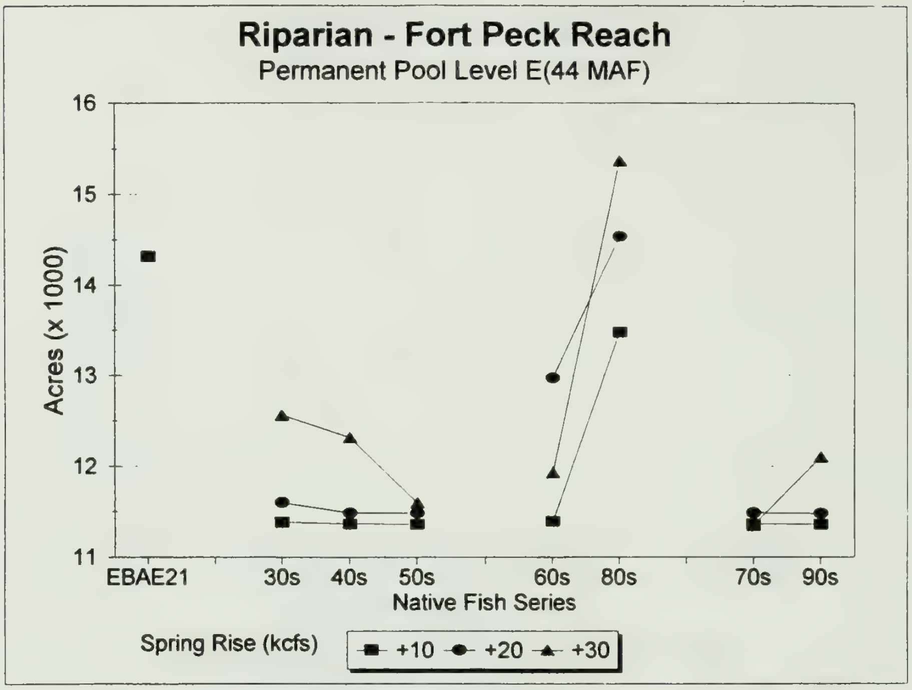

Figure 4-155. Average annual acreage of woody riparian vegetation in Fort Peck reach over the 96-year simulation period for the Native Fish alternatives with permanent pool level of 44 MAF.

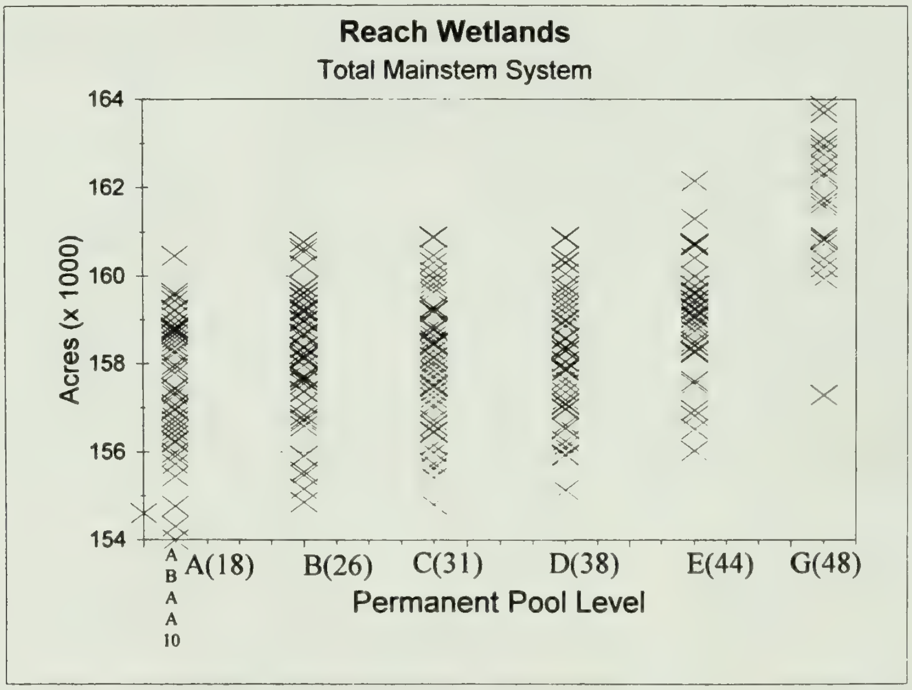

Figure 4-156. Average annual wetland acreage in the Mainstem System over the 96-year simulation period for the Basic Set of alternatives by permanent pool level.

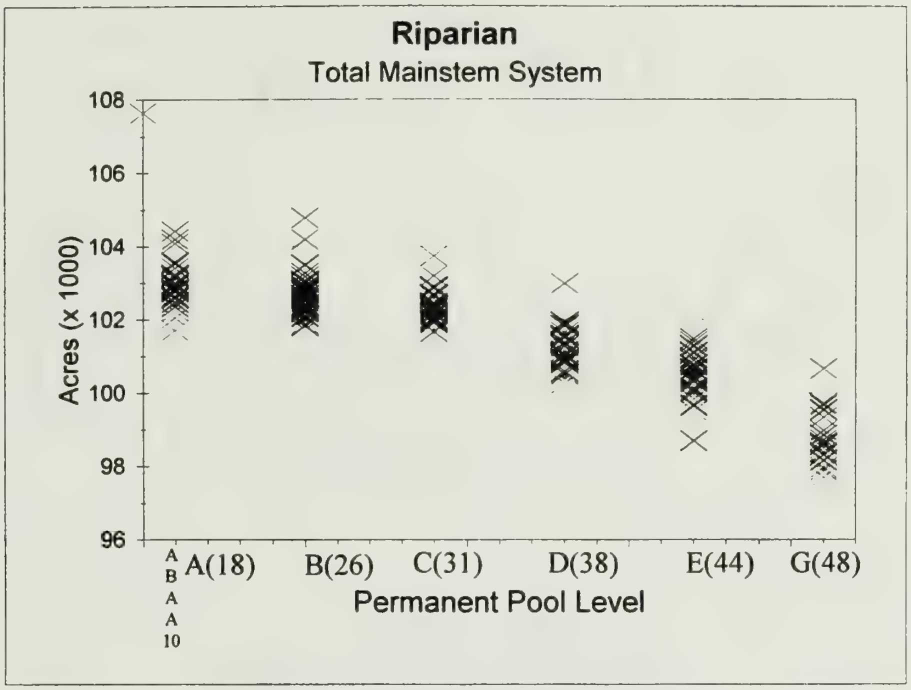

Figure 4-157. Average annual acreage of woody riparian vegetation in the Mainstem System over the 96-year simulation period for the Basic Set of alternatives by permanent pool level.

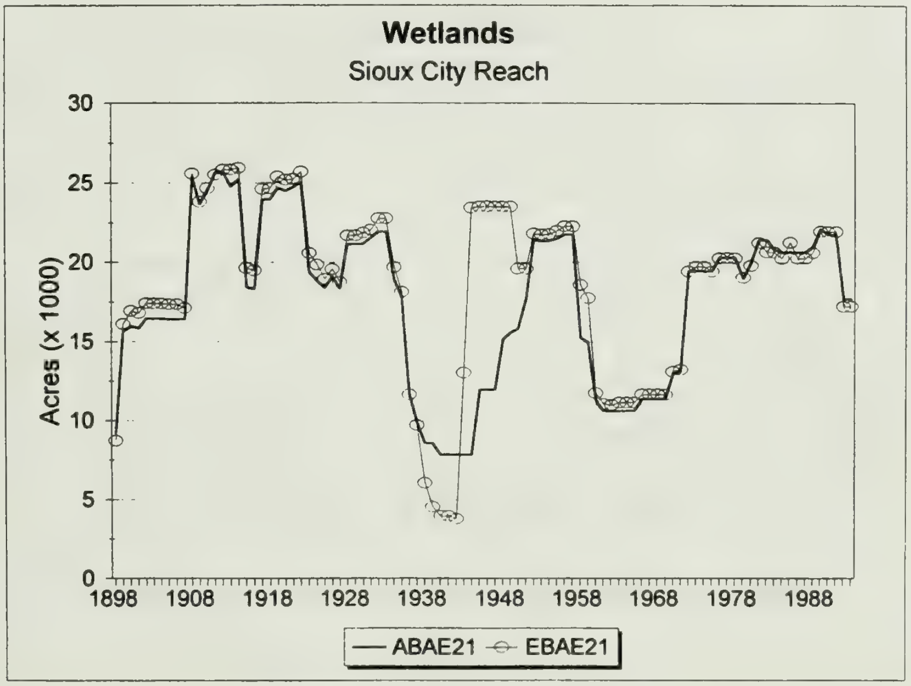

Figure 4-158. Average annual wetland acreage in Sioux City reach over the 96-year simulation period for alternatives ABAE21 and EBAE21.

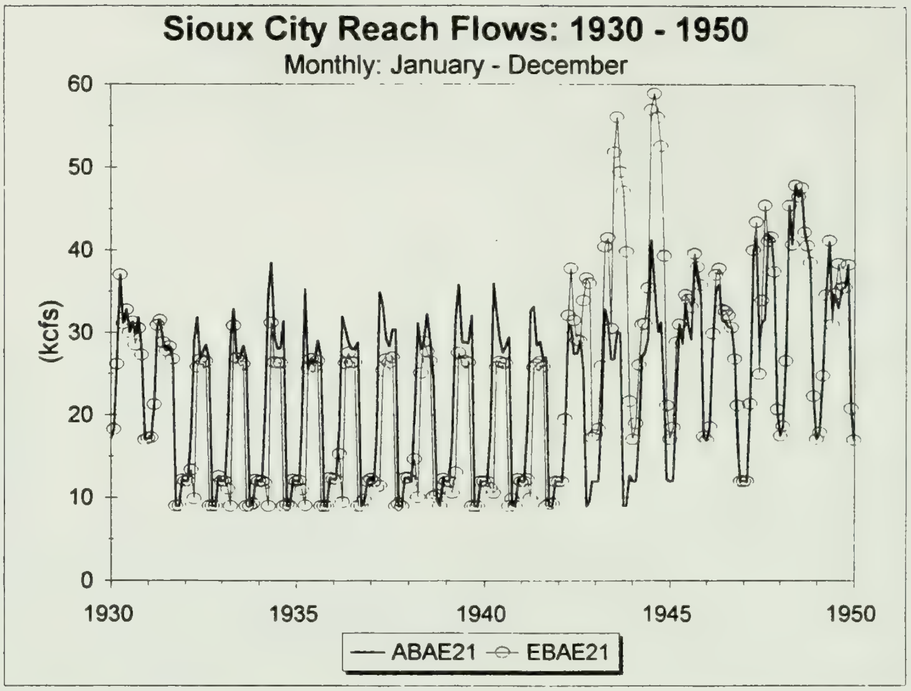

Figure 4-159. Average monthly flow in Sioux City reach from 1930 to 1950 in simulation for alternatives ABAE21 and EBAE21.

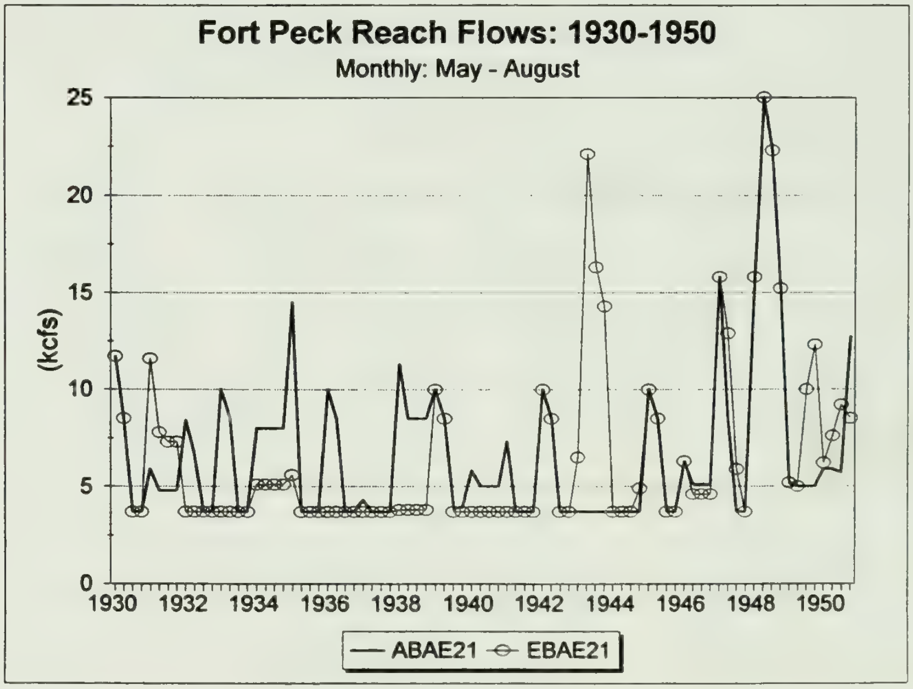

Figure 4-160. Average monthly flow in May, June, July, and August in Fort Peck reach from 1930 to 1965 in simulation for alternatives ABAE21 and EBAE21.

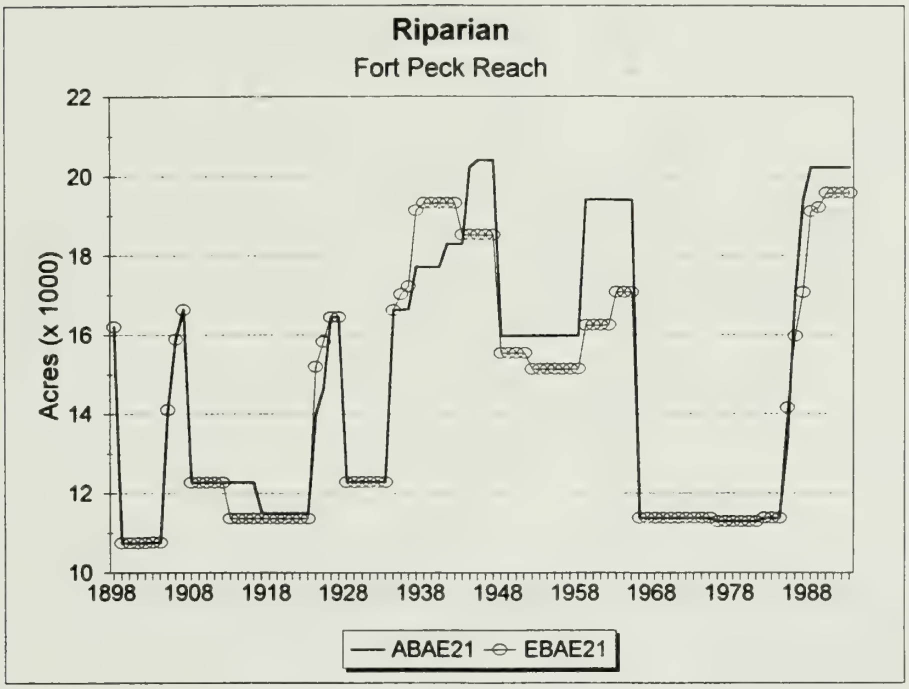

Figure 4-161. Average annual acreage of woody riparian vegetation in Fort Peck reach over the 96-year simulation period for alternatives ABAE21 and EBAE21.

5.0 TERN AND PLOVER HABITAT

The following sections summarize the general trends in tern and plover nesting habitat in relationship to characteristics of the alternatives under consideration. The effects of the following alternative attributes are discussed: (1) modified navigation criteria (service level) and modified intrasystem regulation, (2) minimum nonnavigation service level, (3) Native Fish Series alternatives, and (4) permanent pool. The output of the tern and plover nesting habitat model (Corps, 1994i), which tracks annual acreage of nesting habitat, was used for conducting this assessment.

5.1 MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

5.1.1 Entire River

Compared to the existing operating alternative (ABAA10), adopting the modified navigation criteria (ABAA20) causes total mean tern and plover habitat to decrease by 46 acres or 11 percent (Table 5-1). Small differences in available acreage during several years of the simulation are the primary cause of this decrease (Figure 5-1). Alternative ABAA20 provides more acreage in 35 years, but less in 49 years of the 96-year simulation period. Alternative ABAA20 has an annual maximum of 1,794 acres, while ABAA10 has a maximum of 1,769 acres. There is no clear trend in terms of which set of navigation criteria results in the most habitat during drought years alone.

Combined with the modified intrasystem regulation, the effect of the modified navigation criteria changes sharply. Total mean habitat increases from 542 acres for alternative ABAA11 to 560 acres for alternative ABAA21, a 3-percent increase (Table 5-1). This increase occurs primarily because ABAA21 has more habitat than ABAA11 in 50 of the 96 years simulated, while it has less habitat in only 20 years (Figure 5-1). These two alternatives have almost identical annual maximum acreage (1,547 vs. 1,553 acres). During droughts, alternative ABAA21 tends to have higher acreage than alternative ABAA11 in most years.

Under the existing navigation criteria, changing from balanced to unbalanced intrasystem regulation (alternatives ABAA10 to ABAA11) causes a 110-acre (25-percent) increase in total mean habitat (432 to 542 acres). Under the modified navigation criteria, changing to a modified intrasystem regulation (alternatives ABAA20 to ABAA21) results in an increase from 387 to 560 acres (45 percent) of habitat (Table 5-1). This increase is most obvious during drought years, when alternative ABAA21 has significantly more habitat than ABAA20 (Figure 5-1). Alternative ABAA11 also tends to have more habitat than ABAA10 in most drought years, although there are some years in which ABAA10 has more habitat than ABAA11.

Compared to the current Water Control Plan (ABAA10), a plan with the modified navigation and intrasystem regulation criteria (ABAA21) results in a 128-acre (38 percent) increase in mean habitat acreage.

5.1.2 Downstream of Fort Peck Dam

Within the Fort Peck Dam to Lake Sakakawea reach, adoption of the modified navigation criteria (alternative ABAA10 to ABAA20) results in a 5-acre or 12-percent decrease in mean habitat (Table 5-1). These two alternatives only differ during a few years of the simulation (Figure 5-2) because monthly flow patterns for these two alternatives do not differ significantly (Table 5-2). The slight reduction in the mean acreage under alternative ABAA20 is probably caused by slightly lower or less frequent annual peak flows. The modified navigation criteria with modified intrasystem regulation (alternative ABAA11 to ABAA21) results in a 12-acre increase in the mean habitat acreage in the Fort Peck reach, indicating that modified intrasystem regulation interacts with the navigation criteria (Table 5-1).

For alternatives with either the original or modified navigation criteria, modified intrasystem regulation increases habitat (Table 5-1). These increases occur in several years of the simulation, including but not restricted to drought years (Figure 5-2). During the drought years, alternatives without modified intrasystem regulation have long series of years with zero habitat; whereas, alternatives with the modified intrasystem regulation have: (1) somewhat lower nesting season flows, resulting in fewer years in which habitat is flooded during the nesting season; and (2) slightly higher winter flows that are effective at scouring vegetation (Table 5-2).

Having both modified navigation and intrasystem regulation criteria increases mean habitat from 41 to 75 acres. Even though there is a substantial increase in mean habitat with these changes, there remains a very large number of zero-habitat years in this reach (Figure 5-2).

5.1.3 Downstream of Garrison Dam

Within the Garrison reach, the adoption of the modified navigation criteria (alternative ABAA10 to ABAA20) reduces the mean habitat from 326 to 259 acres (21 percent), mainly due to a 2.4-kcfs increase in July monthly flows and 3.9-kcfs reduction in the mean annual peak monthly flow (Table 5-3). Having both the modified navigation and intrasystem regulation criteria (alternative ABAA11 to ABAA21) causes a 3-percent reduction in mean habitat (411 to 398 acres; Table 5-1).

The modified intrasystem regulation (alternative ABAA10 to ABAA11) causes habitat to increase from 326 to 411 acres (26 percent). With the modified navigation criteria, modified intrasystem regulation criteria (alternative ABAA20 to ABAA21) causes habitat to increase from 259 to 398 acres (54 percent). Modified intrasystem regulation reduces the number of zero-habitat years (Figure 5-3). During drought periods, modified intrasystem regulation results in several years with nearly 1,000 acres of habitat, while under the current regime, there is under 400 acres in virtually all drought years (Figure 5-3).

The overall effect of the modified navigation and intrasystem regulation criteria is an increase of 72 acres (22 percent) of nesting habitat. This difference occurs primarily because alternative ABAA21 has substantially more habitat in several years, especially during drought periods, and has at least as much habitat as the current plan in nearly all other years (Figure 5-3).

5.1.4 Downstream of Fort Randall Dam

Within the Fort Randall Dam to Lewis and Clark Lake reach, the adoption of the modified navigation criteria would increase nesting habitat by approximately 29 percent (Table 5-1). Alternative ABAA10 has the greatest number of zero-habitat years (Figure 5-4). Alternative ABAA20 improves habitat with its 0.8-kcfs increase in the monthly peak flow, which causes increased vegetation scouring (Table 5-4).

Modified intrasystem regulation has little effect on nesting habitat (Table 5-1; Figure 5-4).

The adoption of the modified navigation and intrasystem regulation criteria results in an increase of 7 acres (22 percent). This increase is partially due to performance difference during drought periods. The current plan has a large number of zero-habitat years during the drought, while alternative ABAA21 would have at least some suitable habitat in most drought years (Figure 5-4).

5.1.5 Downstream of Gavins Point Dam

Within the Gavins Point reach, the modified navigation criteria result in a 16-acre (50-percent) increase in the mean habitat acreage compared to the current Water Control Plan. Alternative ABAA20 provides more habitat during the drought years than the current Water Control Plan even though the average hydrology patterns of the two alternatives are similar (Table 5-5). This similarity is due to slightly greater spring and winter flows and lower summer flows during some years. With modified intrasystem regulation, the modified navigation criteria (alternative ABAA11 to ABAA21) result in a 35- to 47-acre increase in mean habitat. Alternative ABAA11 has 29 zero-habitat years, while ABAA21 has only 9 zero-habitat years. The modified navigation criteria increase habitat availability during drought periods (Figure 5-5).

Under the original navigation criteria, modified intrasystem regulation results in a 1.8-acre (6-percent) increase in mean habitat; however, modified intrasystem regulation decreases habitat by 1.9 acres (4 percent) under the modified navigation criteria (Table 5-1). Alternatives ABAA10 and ABAA11 have a similar number of zero-habitat years (Figure 5-5), but annual habitat acreage varies from 0 to 161 acres under ABAA10, while alternative ABAA11 has an annual habitat acreage maximum value of 284 acres. Modified intrasystem regulation improves habitat conditions during the drought years under both sets of navigation criteria (Figure 5.5). Under the modified navigation criteria, the maximum annual habitat acreage changes little with modified intrasystem regulation.

The modified navigation and intrasystem regulation criteria result in a 14.5-acre (44-percent) increase in mean habitat and a significant reduction in the number of years with zero habitat, compared to the current Water Control Plan (Figure 5-5).

5.2 MINIMUM NONNAVIGATION SERVICE LEVEL

The effects of the minimum nonnavigation service level were assessed by comparing the Basic Set of 274 alternatives.

5.2.1 Entire River

Overall within the Basic Set of alternatives, tern and plover habitat varies from 463 acres to 602 acres, compared to 432 for the current Water Control Plan and 1,450 acres under a run-of-river scenario (alternative EVQ2) (Table 5-1). Total mean habitat is generally greatest for alternatives with high winter and spring/fall flows and low summer flows. The effect is confined to drought periods when minimum nonnavigation service levels are applied (see Section 3.2). Increasing winter river flows through higher minimum service levels causes little change in total habitat at low permanent pool levels, but tends to increase habitat at moderate and high permanent pool levels (Figure 5-6). Increases in river flows through higher spring/fall minimum service levels tend to increase total habitat for low to moderate permanent pool levels, but has little effect for 38- and 44-MAF permanent pool level alternatives. Decreasing summer flow causes a substantial increase in total habitat at 48-MAF permanent pool levels, but has no effect at other pool levels (Figure 5-6).

5.2.2 Missouri River from Fort Peck Dam to Lake Sakakawea

Mean tern and plover habitat within the reach from Fort Peck Dam to Lake Sakakawea varies from 65 to 92 acres among the Basic Set of alternatives (Table 5-1). This acreage compares to 319 acres under the run-of-river alternative (EVQ2) and 41 acres for the current Water Control Plan (ABAA10). Because most of the habitat in this reach would be inundated by flows of 12 kcfs, nesting season flows below 12 kcfs expose the most nesting habitat. Flows also must rise above this level at other times to ensure effective removal or inhibition of vegetation growth.

A total of 71 alternatives within all 6 permanent pool levels produce mean habitat acreage greater than 80 acres, indicating that navigation and nonnavigation season flow patterns interact with permanent pool level to affect annual habitat availability (Table 5-1). One characteristic that alternatives with greater mean habitat have in common is that at least one, and often two or more, of the nonnavigation service levels is 12 kcfs or greater. Within a given permanent pool level, the trend in mean habitat acreage in relationship to winter, spring/fall, and summer minimum nonnavigation service levels depends on the pool level (Figure 5-7). Mean habitat varies most with changes in minimum nonnavigation season flows at the 48-MAF permanent pool level (Figure 5-7). Alternatives with 48-MAF permanent pool levels and high winter and high summer minimum nonnavigation flows produce the greatest mean acreage (Table 5-1).

The degree to which tern and plover habitat is maintained during the drought years depends on the specific mix of permanent pool and minimum nonnavigation service level. For example, alternative GDAA21, which produces one of the highest mean values, has at least some habitat in most drought years, but alternative GBBD21 has more zero-habitat years, while alternative BCCE21, which has one of the lowest mean values, performs even worse during droughts (Figure 5-8).

5.2.3 Missouri River from Garrison Dam to Lake Oahe

Under the Basic Set of alternatives, the average annual habitat acreage in the Garrison reach ranges from a low of 258 acres under GCAA21 to a high of 424 acres under DDBB21 (Table 10-1). The run-of-river alternative (EVQ2) and current Water Control Plan (ABAA10) produce mean values of 673 and 326 acres, respectively.

Seventy-five of the 274 basic alternatives have mean habitat values of over 400 acres (Table 10-1). These alternatives include all combinations of minimum nonnavigation service levels, but are restricted to permanent pool levels of 38 MAF and below. At permanent pool levels of 18 through 38 MAF, there is no obvious trend in habitat in response to changing winter minimum nonnavigation service levels; at 44- and 48-MAF permanent pool levels, mean habitat decreases with increasing the winter minimum nonnavigation service level (Figure 5-9). Habitat generally increases with increasing spring/fall minimum navigation flows in all permanent pool levels except 48 MAF, in which there is no obvious trend (Figure 5-9). Within each permanent pool level, nesting habitat acreage increases with increasing summer minimum nonnavigation service level. This trend is most obvious at higher permanent pool levels (Figure 5-9).

5.2.4 Missouri River from Fort Randall Dam to Lewis and Clark Lake

All but 17 of the 274 basic alternatives produce mean habitat in the Fort Randall reach of between 30 and 50 acres (Table 5-1). Mean habitat acreage varies between 36 acres under ADDE21 to 65 acres under GDAA21. This acreage compares to 33 acres under the current Water Control Plan and 127.9 acres for the run-of-river scenario (EVQ2). Habitat is most affected by changes in the permanent pool level and is much less affected by changes in the navigation and nonnavigation flows, except at higher permanent pool levels.

Increasing winter minimum nonnavigation service levels causes Fort Randall reach tern and plover habitat to: (1) decrease slightly at 18-, 26-, and 31-MAF permanent pool levels; (2) remain stable at 38-MAF permanent pool alternatives; and (3) increase substantially for 38- and 44-MAF permanent pool levels (Figure 5-10). Increasing spring/fall flows cause: (1) a very slight decrease in habitat for 18- and 26-MAF permanent pool levels; (2) a small increase in mean habitat for 31- and 38-MAF pool levels; and (3) a more substantial decline in habitat at higher pool levels (Figure 5-10). Mean habitat does not vary significantly with changes in summer minimum nonnavigation service levels (Figure 5-10). However, habitat decreases significantly with increasing summer flow at higher permanent pools (Figure 5-10). Because the lakes above Fort Randall and Gavins Point dams are operated essentially as run-of-river reservoirs, the alternatives that have low summer minimum nonnavigation service levels also have low summer discharges from Fort Randall Dam. This effect tends to expose a greater acreage of habitat in the Fort Randall reach.

5.2.5 Missouri River from Gavins Point Dam to Ponca

The 274 basic alternatives produce between 40 acres under BDDD21 to 113 acres under GDAA21 in the Gavins Point reach (Table 5-1). This range compares to 33 acres under the current Water Control Plan to 329 acres under the run-of-river alternative.

Mean habitat acreage increases substantially with increases in winter minimum flow at permanent pool levels of 38 MAF and above, while those below this storage level do not vary much with winter flow (Figure 5-11). Changing spring/fall minimum flows have almost no effect on habitat acreage, except for a general decrease in habitat at the 44-MAF permanent pool (Figure 5-11). Increasing summer minimum nonnavigation service levels has a negative effect on mean habitat acreage, especially at higher permanent pool levels.

5.3 NATIVE FISH SERIES

The 105 Native Fish Series alternatives were evaluated in relationship to one another and to the corresponding alternative with the same nonnavigation service level and permanent pool level from the Basic Set of 274 alternatives.

5.3.1 Entire River

All of the 105 alternatives developed to maintain and enhance native fish habitat produce tern and plover nesting habitat that is greater than the mean acreage provided under the current Water Control Plan. Several Native Fish Series alternatives produce mean values that are substantially greater than the Basic Set of alternatives. Spring service level, flood control criteria, and shortened navigation season account for the change. Overall, the mean habitat value varies from a low of 448 acres under alternative DBAE71 to a high of 644 acres under ABAE83 (Table 5-1).

Total mean habitat acreage increases with increasing spring flows at all permanent pool levels, although there is some interaction with level of flood control and the months that navigation is not supported (Figures 5-12 through 5-16). In general, within each permanent pool level, those alternatives with spring service levels of 45 kcfs produce less habitat than the equivalent alternative with a 35-kcfs service level, while those alternatives with a 65-kcfs service level produce mean habitat values that are substantially greater than the 35-kcfs alternative with the same pool level (Figures 5-12 through 5-16). The alternatives with 55-kcfs spring service level tend to have means similar to the equivalent 35-kcfs service level alternative, although there is a great deal of interaction with the other factors at the higher permanent pool levels.

The number of flood control constraints also affect the mean acreage of habitat available. However, the effects are different depending on whether or not the alternative has months in which navigation is not supported. At low permanent pool levels, the acreage decreases with a reduction and elimination of limits on navigation releases for flood control within each spring service level (Figures 5-12 and 5-13). At the 31-MAF permanent pool level, there is an interaction with spring service level; at the 55- and 65-kcfs levels, habitat decreases, while at the 45 kcfs, habitat increases (Figure 5-14). At higher permanent pool levels, the acreage is highly dependent on the combination of spring service level and flood control constraints (Figures 5-15 and 5-16).

For alternatives that have no navigation support in some months, the habitat changes depending on (1) permanent pool level, (2) the month navigation is not supported (August/September or October/November), and (3) the spring service level (Figures 5-12 through 5-16).

The shortened navigation season appears to have a neutral or slightly positive effect on total mean habitat acreage, except at 44-MAF permanent pool levels, where differences are caused by other factors (Figures 5-12 through 5-16). The magnitude of change from the equivalent alternative without navigation limitations also depends on whether August/September or October/November navigation is eliminated. Alternatives with high spring service levels are similar in habitat acreage regardless of which months are eliminated; whereas, mean habitat varies significantly between alternatives with August/September and October/November navigation at the 45- or 55-kcfs spring service levels. Alternatives in which August/September are the months eliminated have similar habitat acreage as the equivalent BAE21 alternative, while those with October/November sometimes have much less habitat than the BAE21 alternative, depending on spring service level (Figures 5-12 through 5-16).

5.3.2 Fort Peck to Williston Reach

All but 14 of the 105 Native Fish Series alternatives provide more habitat in the Fort Peck reach than the current Water Control Plan (Table 5-1). Virtually all Native Fish Series alternatives provide less habitat than the corresponding BAE21 alternative, except for alternative BBAE83 and several alternatives with 44-MAF permanent pool and 6-month navigation seasons (Figures 5-17 through 5-21). In general, the lower the spring service level, the greater the acreage; although there is significant interaction with the limitation of navigation releases for flood control and permanent pool level. The alternatives with the existing limits on releasing water for flood control usually have lower acreage than alternatives with reduced or eliminated limits, except for several alternatives in the 18- and 44-MAF permanent pool levels with high spring service levels (Figures 5-16 through 5-21). The shortened navigation season results in little change at permanent pool levels below 38 MAF; however, at these levels, the habitat is increased with August/September elimination of navigation, especially when the limitations for releasing water for flood control are eliminated (Figures 5-16 through 5-21).

5.3.3 Garrison Reach

Most of the Native Fish Series alternatives produce mean habitat values that are similar to or below the equivalent BAE21 alternative levels, although at least one alternative in each of the permanent pool levels except 38 MAF exceeds the BAE21 levels (Figures 5-22 through 5-26). The degree of change depends on the spring service level, whether navigation releases are constrained for flood control, and the navigation season is shortened. Increasing the spring service level causes an increase in the mean habitat acreage at all pool levels except 44 MAF. With a 44-MAF pool level, there is a great deal of interaction with other factors. At 45- and 55-kcfs spring service levels, habitat increases with a reduction and elimination of constraints on navigation releases for flood control. At the 65-kcfs spring service level, effects vary with permanent pool level (Figures 5-22 through 5-26). At the 44-MAF permanent pool level, the August/September shortened navigation season causes a major reduction in habitat compared to the equivalent Native Fish Series alternative without flood control constraints. At other permanent pool levels, alternatives with 55 and 65 kcfs spring service level have less habitat, while 45 kcfs spring service alternatives show little difference from the equivalent Native Fish Series alternative without flood control constraints (Figures 5-22 through 5-26).

5.3.4 Fort Randall Reach

Nearly all of the Native Fish Series alternatives have a higher mean habitat acreage than the equivalent BAE21 alternative. The exceptions to this include the alternatives with no navigation in October/November, and no flood control constraints and a 55-kcfs spring service level (Figures 5-27 through 5-31). Within each permanent pool level, mean habitat increases with an increase in spring service level, although alternatives with no flood control constraints and 55-kcfs spring service level tend to have equal or slightly less habitat than the equivalent alternative with 45-kcfs spring releases (Figures 5-27 through 5-31).

Eliminating navigation during August/September substantially increases habitat at all permanent pool levels, regardless of flood control constraints (Figures 5-27 through 5-31). Eliminating navigation in October/November also positively affects tern and plover nesting habitat compared to the equivalent Native Fish Series alternative without the shortened season.

5.3.5 Gavins Point Reach

Within each permanent pool level, many of the Native Fish Series alternatives have mean habitat values that are significantly greater than the corresponding BAE21 alternative. Only a few alternatives with 45-kcfs spring service levels and no flood control constraints have values similar to or slightly below the level provided by the equivalent BAE21 alternative (Figures 5-32 through 5-36). Within each permanent pool level, habitat increases with an increase in the spring service level (Figures 5-32 through 5-36). Habitat decreases as flood control constraints are reduced or eliminated.

The shortened navigation season effects are dependent on which months are eliminated. Elimination of navigation during August/September tends to produce significant increases in habitat compared to the comparable Native Fish Series alternative with a full navigation season. Elimination of navigation during October/November, however, results in only a slight positive change. The exception to this is at the 44-MAF permanent pool level where the effect depends on the spring service level (Figures 5-32 through 5-36).

5.4 PERMANENT POOL LEVEL

As already discussed in the previous sections of this report, predicted mean tern and plover habitat varies greatly with the combination of pool level and other criteria used in alternative development. This section summarizes the permanent pool effects alone for the Basic Set of alternatives; see the previous sections for the interactive effects of permanent pool and the other criteria.

5.4.1 Entire River

The total tern and plover habitat is relatively equal among permanent pools of 44 MAF and below, while some of the lower acreages result from 48-MAF pool level alternatives (Figure 5-37). Generally, higher permanent pool levels result in depressed habitat acreage during extended droughts such as the 1930s (Figure 5-38).

5.4.2 Fort Peck Reach

The habitat in the Fort Peck reach depends on a complex combination of permanent pool and the other factors and no trend with permanent pool alone is obvious (Table 5-1).

5.4.3 Garrison Reach

Mean habitat is similar at pool levels of 18, 26, 31, and 38 MAF, but further increases in permanent pool cause a decline. Most of the alternatives with a 48-MAF permanent pool level produce less habitat than the current Water Control Plan (Table 5-1).

5.4.4 Fort Randall Reach

In the Fort Randall reach, mean habitat is similar at pool levels of 18, 26, and 31 MAF, but habitat increases substantially as the pool level increases above this level (Table 5-1).

5.4.5 Gavins Point Reach

In the Gavins Point reach, mean habitat is similar at pool levels of 18 and 26 MAF, but habitat increases substantially as the pool level increases above this level (Table 5-1).

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
ABAA10	432.0	40.8	325.7	32.7	32.8
ABAA11	541.8	63.2	410.6	33.4	34.6
ABAA20	386.6	36.1	259.0	42.2	49.2
AAAA21	548.7	60.7	401.3	40.2	46.6
AAAB21	548.7	60.7	401.3	40.2	46.6
AAAC21	548.7	60.7	401.3	40.2	46.6
AAAD21	548.7	60.7	401.3	40.2	46.6
AAAE21	548.7	60.7	401.3	40.2	46.6
AABB21	560.7	69.6	408.1	39.8	43.2
AABC21	560.7	69.6	408.1	39.8	43.2
AABD21	560.7	69.6	408.1	39.8	43.2
AABE21	560.7	69.6	408.1	39.8	43.2
AACC21	559.3	69.6	406.2	39.8	43.8
AACD21	559.3	69.6	406.2	39.8	43.8
AACE21	559.3	69.6	406.2	39.8	43.8
AADD21	572.7	87.8	397.5	39.8	47.6
AADE21	574.5	87.4	400.3	39.7	47.1
AAEE21	571.5	71.2	415.9	37.9	46.5
ABAA21	559.9	74.8	397.9	39.9	47.3
ABAB21	559.9	74.8	397.9	39.9	47.3
ABAC21	559.9	74.8	397.9	39.9	47.3
ABAD21	559.9	74.8	397.9	39.9	47.3
ABAE21	559.9	74.8	397.9	39.9	47.3
ABBB21	561.4	74.8	400.7	39.9	45.9
ABBC21	560.0	74.8	400.7	39.4	45.1
ABBD21	564.8	74.8	402.9	39.4	47.7
ABBE21	563.6	74.8	405.0	39.7	44.1
ABCC21	570.2	86.3	395.2	39.0	49.6
ABCD21	566.7	86.3	395.9	39.4	45.0
ABCE21	555.5	87.2	384.7	39.4	44.1
ABDD21	569.9	74.8	407.8	38.5	48.8
ABDE21	571.0	74.8	411.6	38.2	46.4
ACAA21	548.2	79.3	384.3	38.6	46.1
ACAB21	548.5	79.3	385.8	38.3	45.1
ACAC21	552.5	79.3	388.8	38.4	46.1
ACAD21	554.0	79.3	392.7	38.1	43.9
ACAE21	550.8	79.3	390.6	37.7	43.3

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
ACBB21	556.0	79.3	390.6	38.5	47.7
ACBC21	557.2	79.3	394.2	37.7	46.0
ACBD21	551.4	77.5	391.5	38.1	44.3
ACBE21	529.3	62.3	385.5	38.1	43.3
ACCC21	558.3	79.3	394.2	38.2	46.6
ACCD21	539.5	62.3	395.9	38.1	43.1
ACCE21	552.5	77.5	395.5	37.8	41.8
ACDD21	553.2	79.3	391.2	38.4	44.4
ACDE21	544.8	79.2	383.3	37.6	44.7
ADAA21	559.6	83.7	389.2	39.1	47.6
ADAB21	564.0	83.7	397.0	38.0	45.3
ADAC21	575.6	83.7	409.4	37.4	45.0
ADAD21	549.1	66.8	402.3	37.4	42.5
ADAE21	557.6	83.7	395.6	37.3	40.9
ADBB21	582.3	82.9	412.5	38.5	48.4
ADBC21	572.8	68.1	418.2	38.0	48.5
ADBD21	555.8	67.7	405.9	38.3	43.9
ADBE21	564.7	81.1	404.1	37.6	41.9
ADCC21	550.0	63.2	402.4	37.6	46.7
ADCD21	582.0	80.6	417.6	37.5	46.3
ADCE21	534.2	65.4	387.3	37.1	44.4
ADDD21	563.3	85.0	398.3	37.0	43.0
ADDE21	517.2	65.5	372.0	36.4	43.4
BAAA21	559.6	60.7	411.6	40.2	47.1
BAAB21	559.6	60.7	411.6	40.2	47.1
BAAC21	559.6	60.7	411.6	40.2	47.1
BAAD21	559.6	60.7	411.6	40.2	47.1
BAAE21	560.0	60.7	412.1	40.2	47.1
BABB21	546.8	75.8	381.6	40.4	49.0
BABC21	545.6	75.8	381.6	40.2	48.0
BABD21	557.4	75.8	393.9	40.2	47.5
BABE21	549.2	76.7	385.6	40.1	46.8
BACC21	572.2	86.9	394.9	40.4	50.1
BACD21	562.6	87.8	386.7	40.1	48.0
BACE21	576.0	86.9	402.1	40.1	46.9
BADD21	569.2	88.7	393.0	40.2	47.4
BADE21	577.8	89.6	401.8	40.0	46.5

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
BBAA21	551.5	81.6	383.1	40.3	46.4
BBAB21	540.8	70.9	380.8	41.1	48.0
BBAC21	538.9	70.9	382.2	39.7	46.1
BBAD21	535.8	70.9	380.8	40.0	44.1
BBAE21	535.3	70.9	381.5	39.6	43.3
BBBB21	535.4	70.9	377.4	39.6	47.5
BBBC21	548.3	82.4	380.6	39.4	45.9
BBBD21	566.0	82.4	396.2	39.7	47.6
BBBE21	557.6	80.7	394.6	39.2	43.1
BBCC21	552.3	70.9	394.8	39.7	46.9
BBCD21	570.2	83.3	404.2	39.1	43.6
BBCE21	568.0	83.3	402.5	39.1	43.2
BBDD21	560.7	74.0	403.7	39.2	43.8
BBDE21	577.4	76.6	419.1	38.6	43.0
BCAA21	562.5	80.1	393.4	40.4	48.6
BCAB21	561.0	79.3	391.9	39.2	50.7
BCAC21	563.9	79.3	399.8	38.8	46.0
BCAD21	572.4	79.3	408.1	38.7	46.4
BCAE21	532.8	62.3	389.4	38.5	42.5
BCBB21	556.1	80.1	389.8	38.6	47.5
BCBC21	560.5	79.3	396.3	38.1	46.9
BCBD21	561.1	79.3	400.9	38.1	42.8
BCBE21	526.0	62.3	383.2	38.0	42.5
BCCC21	559.8	77.5	391.1	38.9	52.4
BCCD21	547.8	78.4	386.6	38.2	44.6
BCCE21	551.5	58.8	408.6	38.2	45.9
BCDD21	555.4	80.1	393.1	38.4	43.8
BCDE21	552.2	79.3	393.1	37.8	42.1
BDAA21	505.4	71.7	350.0	37.1	46.6
BDAB21	567.3	85.0	396.7	38.7	46.9
BDAC21	552.6	68.1	401.1	38.0	45.3
BDAD21	568.5	85.5	399.1	38.5	45.5
BDAE21	568.4	85.0	405.0	37.9	40.5
BDBB21	578.4	85.9	406.6	38.1	47.8
BDBC21	568.0	85.0	397.2	37.9	47.9
BDBD21	564.1	84.2	400.0	37.7	42.3
BDBE21	558.2	64.6	416.0	37.1	40.5

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
BDCC21	575.1	85.0	402.2	39.0	49.0
BDCD21	561.9	84.2	396.5	38.8	42.5
BDCE21	553.0	84.2	390.0	37.7	41.2
BDDD21	536.2	64.2	395.4	37.0	39.6
CAAA21	551.6	58.5	394.1	40.2	58.9
CAAB21	565.7	72.7	395.0	40.2	57.8
CAAC21	571.2	73.6	400.8	40.0	56.8
CAAD21	564.1	73.6	394.4	40.0	56.1
CAAE21	562.9	73.6	394.1	39.4	55.8
CABB21	572.7	76.3	394.4	39.7	62.3
CABC21	572.4	76.3	395.2	40.7	60.3
CABD21	560.1	73.6	387.9	40.3	58.3
CABE21	562.3	73.6	394.2	39.7	54.8
CACC21	558.9	73.6	383.8	39.5	62.0
CACD21	566.9	73.6	393.9	39.7	59.6
CACE21	541.1	58.5	387.5	39.3	55.9
CADD21	566.1	73.6	392.7	40.0	59.8
CADE21	568.5	73.6	400.7	39.1	55.1
CBAA21	532.6	70.4	359.9	40.8	61.6
CBAB21	550.6	72.2	375.3	40.7	62.4
CBAC21	538.7	71.3	368.3	39.1	60.0
CBAD21	525.6	59.8	368.5	39.1	58.2
CBAE21	532.4	71.3	367.0	39.1	55.0
CBBB21	532.0	59.8	369.9	39.8	62.5
CBBC21	536.9	71.3	367.7	38.6	59.3
CBBD21	546.0	71.3	377.0	39.1	58.6
CBBE21	545.5	71.3	379.5	39.6	55.2
CBCC21	536.2	70.0	366.6	38.9	60.6
CBCD21	544.8	70.0	377.8	38.1	59.0
CBCE21	520.0	54.9	372.2	38.4	54.5
CBDD21	576.2	71.6	401.6	39.6	63.3
CBDE21	576.4	83.2	400.4	39.1	53.7
CCAA21	545.0	77.0	367.5	39.2	61.3
CCAB21	543.1	78.3	366.2	38.1	60.5
CCAC21	549.9	79.2	375.6	37.5	57.5
CCAD21	554.6	77.0	382.8	37.6	57.2
CCAE21	548.0	77.0	379.4	38.1	53.5

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Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
CCBB21	553.9	78.3	378.5	37.5	59.5
CCBC21	560.0	77.0	387.1	37.5	58.3
CCBD21	568.9	78.3	396.5	37.0	57.1
CCBE21	540.4	56.6	393.9	37.8	52.2
CCCC21	576.0	74.0	398.1	39.8	64.1
CCCD21	552.5	55.3	395.5	39.5	62.2
CCCE21	563.7	76.6	395.1	39.1	52.9
CCDD21	571.7	73.1	392.8	38.7	67.2
CDAA21	578.5	88.5	391.0	38.3	60.6
CDAB21	576.4	88.5	391.8	37.2	58.9
CDAC21	591.9	88.5	408.8	36.6	57.9
CDAD21	590.3	84.5	405.6	38.5	61.7
CDAE21	537.3	65.0	383.6	36.8	52.0
CDBB21	563.1	80.2	381.6	38.5	62.9
CDBC21	579.2	79.3	397.9	38.7	63.3
CDBD21	555.1	59.8	393.7	38.4	63.3
CDBE21	557.6	79.3	388.2	37.9	52.1
CDCC21	541.4	55.3	386.0	37.5	62.6
CDCD21	593.3	72.2	411.4	40.3	69.4
CDDD21	575.3	81.1	389.4	38.9	65.8
DAAA21	568.8	70.0	403.3	42.8	52.6
DAAB21	563.8	69.1	402.3	41.6	50.7
DAAC21	572.6	71.7	409.7	41.2	49.9
DAAD21	553.5	67.4	399.7	39.5	46.9
DAAE21	558.6	69.1	401.9	41.2	46.4
DABB21	549.5	60.7	396.2	41.4	51.2
DABC21	550.5	60.7	399.7	40.5	49.5
DABD21	512.1	66.8	358.7	39.9	46.7
DABE21	573.7	79.3	406.4	41.5	46.5
DACC21	557.2	77.1	384.6	40.9	54.5
DACD21	557.2	77.1	384.6	40.9	54.5
DACE21	569.4	74.5	407.3	40.9	46.7
DADD21	585.4	69.1	420.9	41.3	54.2
DBAA21	547.6	67.7	370.0	44.6	65.3
DBAB21	537.2	67.7	368.0	41.9	59.6
DBAC21	520.3	57.9	367.3	40.6	54.4
DBAD21	525.9	67.7	367.2	40.2	50.7

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
DBAE21	529.7	68.6	373.3	40.9	46.9
DBBB21	530.3	63.3	368.7	41.4	56.9
DBBC21	537.5	73.1	368.8	40.5	55.0
DBBD21	534.5	74.0	372.5	40.8	47.2
DBBE21	548.5	70.4	394.3	40.4	43.4
DBCC21	540.8	71.4	372.6	40.8	56.0
DBCD21	560.5	68.7	397.4	40.5	53.9
DBDD21	565.4	82.0	392.9	40.9	49.6
DCAA21	539.4	56.1	379.2	43.8	60.4
DCAB21	528.2	56.1	374.3	41.4	56.3
DCAC21	544.1	72.1	377.3	40.6	54.1
DCAD21	541.9	72.1	378.6	41.0	50.1
DCAE21	560.0	70.8	405.9	40.0	43.3
DCBB21	556.4	61.4	396.2	41.8	57.1
DCBC21	556.4	61.4	400.5	41.4	53.1
DCBD21	551.8	61.4	403.5	40.3	46.7
DCBE21	531.5	72.2	371.7	41.3	46.3
DCCC21	589.7	78.3	413.6	39.8	58.0
DCCD21	573.8	78.8	403.2	41.7	50.1
DCDD21	552.5	71.7	370.1	45.7	65.0
DDAA21	586.0	80.1	405.7	42.1	58.1
DDAB21	574.5	65.8	398.1	43.7	66.9
DDAC21	563.3	64.9	399.5	40.5	58.4
DDAD21	574.4	80.1	402.5	39.3	52.5
DDAE21	518.6	74.9	358.9	39.1	45.7
DDBB21	588.5	67.2	423.5	40.7	57.1
DDBC21	601.8	85.9	415.0	40.8	60.2
DDBD21	594.8	84.1	417.8	40.3	52.7
DDCC21	602.4	80.1	421.1	40.8	60.3
DDCD21	550.7	82.0	359.8	44.2	64.7
EAAA21	529.6	57.0	347.4	49.1	76.2
EAAB21	533.8	58.8	360.4	45.6	68.9
EAAC21	537.1	62.5	367.1	43.9	63.6
EAAD21	538.0	75.9	364.2	41.8	56.2
EAAE21	559.5	75.9	394.8	41.3	47.6
EABB21	537.6	62.5	359.2	45.9	70.0
EABC21	537.8	75.0	358.6	43.0	61.3

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
EABD21	539.5	69.1	368.6	42.3	59.4
EABE21	553.3	68.2	396.4	41.1	47.5
EACC21	553.1	74.5	373.5	42.9	62.2
EACD21	540.5	68.2	373.9	41.8	56.6
EADD21	551.5	79.0	377.8	41.1	53.6
EBAA21	544.1	67.9	349.4	49.5	77.2
EBAB21	534.4	69.7	349.0	46.0	69.7
EBAC21	552.9	77.6	361.1	44.9	69.3
EBAD21	532.1	76.4	360.4	41.4	53.9
EBAE21	527.9	67.8	371.5	41.1	47.5
EBBB21	550.3	73.1	353.6	47.4	76.3
EBBC21	548.4	69.4	365.5	44.1	69.4
EBBD21	528.6	74.9	354.4	42.3	57.0
EBCC21	584.5	82.2	389.4	44.7	68.3
EBCD21	559.7	82.2	380.2	42.2	55.1
ECAA21	555.6	87.4	338.6	49.4	80.3
ECAB21	544.4	86.5	339.2	45.2	73.5
ECAC21	550.3	80.1	356.8	43.9	69.5
ECAD21	572.3	82.9	387.2	42.7	59.4
ECBB21	532.2	73.8	338.9	45.1	74.4
ECBC21	575.2	75.7	387.1	44.0	68.3
ECBD21	546.2	78.4	369.0	42.1	56.8
ECCC21	532.2	58.3	347.5	46.8	79.6
ECCD21	546.5	76.7	352.7	46.3	70.8
EDAA21	569.4	87.0	334.6	54.4	93.4
EDAB21	565.9	78.0	347.5	50.8	89.7
EDAC21	532.1	58.4	341.6	47.3	84.8
EDBB21	567.2	78.0	343.2	51.9	94.1
EDBC21	555.2	58.4	369.5	46.9	80.3
EDBD21	539.7	75.3	355.1	44.7	64.5
EDCC21	574.6	80.0	375.0	46.0	73.6
GAAA21	506.7	89.1	282.5	54.3	80.8
GAAB21	513.5	81.0	297.5	55.4	79.6
GAAC21	499.7	80.1	298.7	50.0	70.9
GAAD21	560.1	88.4	362.9	48.1	60.8
GAAE21	543.9	91.7	355.5	46.3	50.4
GABB21	490.4	83.9	264.5	52.8	89.1

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
GABC21	478.8	81.8	264.7	50.2	82.2
GABD21	470.2	65.7	283.0	48.8	72.6
GACC21	489.7	67.6	290.1	50.3	81.6
GACD21	487.0	67.6	295.6	49.7	74.1
GBAA21	529.0	81.3	286.6	59.8	101.3
GBAB21	478.5	62.6	277.6	52.5	85.7
GBAC21	468.4	62.6	277.3	49.6	78.9
GBAD21	462.9	62.6	281.0	48.9	70.5
GBBB21	493.5	68.9	273.0	56.0	95.6
GBBC21	473.7	62.6	282.8	49.2	79.1
GBBD21	481.4	62.6	298.8	48.7	71.3
GBCC21	497.7	64.8	292.0	50.8	90.2
GCAA21	512.3	83.4	258.2	63.0	107.7
GCAB21	493.0	66.1	277.8	54.4	94.6
GCAC21	487.9	64.8	283.0	51.7	88.5
GCAD21	476.2	64.8	285.8	47.7	77.9
GCBB21	502.0	65.7	284.7	56.1	95.6
GDAA21	537.6	91.6	268.4	64.5	113.2
ABAE31	535.5	56.4	352.0	53.4	73.7
BBAE31	524.7	57.3	340.4	53.1	73.9
CBAE31	500.6	51.0	320.2	54.8	74.6
DBAE31	484.3	47.9	302.9	56.9	76.6
EBAE31	501.0	67.6	299.2	57.4	76.9
ABAE32	576.4	44.6	375.8	64.1	91.9
BBAE32	571.5	46.8	365.8	64.8	94.2
CBAE32	548.1	37.9	352.1	65.0	93.1
DBAE32	519.3	30.3	325.5	67.4	96.2
EBAE32	571.1	57.9	341.5	69.8	101.9
ABAE33	620.8	42.3	407.1	72.6	98.7
BBAE33	609.0	42.7	395.9	72.8	97.6
CBAE33	606.1	47.6	383.5	73.6	101.4
DBAE33	591.5	48.6	367.9	74.7	100.3
EBAE33	549.5	29.8	311.2	84.7	123.8
ABAE41	528.9	55.9	365.3	45.2	62.5
BBAE41	517.9	60.8	347.6	45.6	63.9
CBAE41	506.7	56.9	339.9	46.2	63.8
DBAE41	470.7	53.3	303.7	49.1	64.6

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
EBAE41	490.4	60.5	312.5	50.0	67.4
ABAE42	564.5	43.5	387.3	51.3	82.4
BBAE42	561.7	50.4	376.7	52.5	82.1
CBAE42	545.9	43.8	366.7	53.0	82.4
DBAE42	522.7	42.7	347.6	49.5	82.9
EBAE42	528.3	58.0	335.2	50.9	84.3
ABAE43	624.5	55.6	404.5	71.2	93.2
BBAE43	618.8	58.2	393.0	72.1	95.5
CBAE43	604.8	53.4	383.3	72.4	95.6
DBAE43	616.4	67.8	375.7	73.5	99.5
EBAE43	543.3	34.8	319.1	79.9	109.4
ABAE51	522.3	61.9	373.9	39.9	46.7
BBAE51	514.1	60.5	366.1	40.8	46.7
CBAE51	508.4	56.6	363.4	41.2	47.3
DBAE51	479.5	59.7	328.0	42.7	49.0
EBAE51	486.4	52.4	337.5	44.7	51.7
ABAE52	529.3	43.2	383.2	37.9	64.9
BBAE52	530.5	44.9	380.0	39.2	66.3
CBAE52	525.2	51.2	367.5	40.2	66.2
DBAE52	462.4	30.9	322.1	42.9	66.5
EBAE52	504.2	41.4	358.7	41.1	62.9
ABAE53	584.4	37.0	400.2	60.0	87.2
BBAE53	592.8	47.3	400.3	60.2	85.1
CBAE53	587.7	49.7	384.9	62.4	90.7
DBAE53	566.0	50.5	362.5	62.5	90.5
EBAE53	605.4	51.1	396.6	73.1	84.6
ABAE61	560.5	54.0	347.4	63.4	95.6
BBAE61	560.2	56.6	341.1	64.9	97.5
CBAE61	557.1	60.6	331.1	66.1	99.3
DBAE61	520.9	55.2	299.6	67.0	99.1
EBAE61	517.5	47.9	297.9	69.1	102.7
ABAE62	571.8	57.6	328.8	70.8	114.6
BBAE62	560.5	56.3	318.3	70.8	115.1
CBAE62	533.4	45.2	300.2	72.0	115.9
DBAE62	560.7	57.6	313.0	73.4	116.6
EBAE62	549.0	46.2	288.9	80.3	133.5
ABAE63	636.5	64.7	374.8	79.8	117.2

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
BBAE63	643.5	68.6	373.9	81.7	119.3
CBAE63	600.0	51.5	348.3	81.7	118.6
DBAE63	634.7	62.9	368.5	82.8	120.5
EBAE63	598.9	53.8	311.0	91.5	142.7
ABAE71	506.3	54.0	341.7	47.9	62.7
BBAE71	497.9	56.6	331.6	44.7	65.0
CBAE71	476.6	51.4	316.6	45.3	63.2
DBAE71	448.1	48.8	286.6	46.7	66.0
EBAE71	489.8	67.3	306.0	49.6	66.9
ABAE72	569.4	39.0	379.6	62.5	88.3
BBAE72	550.6	46.6	353.5	62.6	87.9
CBAE72	534.0	39.1	342.7	63.6	88.5
DBAE72	511.7	29.5	329.2	63.6	89.3
EBAE72	564.7	53.2	348.9	67.0	95.6
ABAE73	625.3	50.4	398.5	75.6	100.9
BBAE73	610.0	49.4	383.8	75.6	101.2
CBAE73	602.8	43.7	379.6	77.0	102.5
DBAE73	597.0	52.9	363.8	78.3	102.0
EBAE73	592.0	54.3	355.9	77.2	104.6
ABAE81	558.3	56.6	359.4	57.3	85.1
BBAE81	553.0	57.4	351.1	58.9	85.7
CBAE81	546.8	58.7	343.1	59.4	85.6
DBAE81	526.3	57.7	321.2	61.7	85.7
EBAE81	550.2	72.0	299.5	72.5	106.2
ABAE82	575.5	51.8	356.9	65.6	101.2
BBAE82	563.6	50.5	346.8	65.5	100.8
CBAE82	544.4	36.1	340.4	66.5	101.4
DBAE82	540.7	46.3	324.3	68.3	101.9
EBAE82	608.1	102.7	290.4	82.0	133.0
ABAE83	644.2	75.1	378.0	78.4	112.7
BBAE83	641.7	81.3	370.3	78.9	111.3
CBAE83	607.5	61.4	353.7	80.1	112.4
DBAE83	581.3	55.9	330.2	81.8	113.4
EBAE83	567.7	47.1	292.5	92.6	135.5
ABAE91	517.0	67.4	358.4	41.8	49.4
BBAE91	502.9	67.8	343.4	42.0	49.7
CBAE91	495.4	64.0	339.2	42.2	50.0

Table 5-1. Average annual tern and plover habitat in the Mainstem System over the 96-year simulation period (in acres).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam
DBAE91	461.7	54.7	314.0	43.4	49.6
EBAE91	501.1	85.1	313.8	46.7	55.6
ABAE92	531.3	39.4	379.4	38.0	74.4
BBAE92	530.0	40.7	376.6	38.1	74.6
CBAE92	513.4	32.7	365.9	39.0	75.7
DBAE92	499.2	27.6	354.5	37.9	79.3
EBAE92	536.4	51.8	364.5	39.7	80.4
ABAE93	619.6	46.9	407.1	73.0	92.6
BBAE93	615.3	48.6	400.5	73.1	93.2
CBAE93	610.9	54.1	388.1	74.4	94.3
DBAE93	591.7	47.6	374.7	76.2	93.3
EBAE93	563.0	32.1	343.7	80.0	107.2
EVQ2XX	1449.6	319.5	673.5	127.9	328.7

Table 5-2. Flow statistics for Fort Peck Dam over the 96-year simulation period (in kcfs).

Alternative		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ABAA10	Average	10.1	10.1	8.1	7.3	9.0	8.1	7.7	7.7	10.6	11.1	9.1	9.0
	Maximum	12.5	12.5	14.3	16.0	25.0	25.0	25.0	22.3	16.0	16.0	16.0	11.3
	Minimum	6.0	4.0	3.7	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.2	2.2	3.1	3.5	4.0	4.9	5.1	4.3	4.1	4.1	3.7	1.7
ABAA20	Average	10.1	10.3	8.5	7.3	9.3	8.6	7.9	8.1	10.0	9.5	8.6	8.9
	Maximum	12.5	12.5	14.3	16.0	24.4	23.4	25.0	22.3	21.3	16.0	16.0	11.3
	Minimum	6.0	6.0	4.5	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.3	2.2	3.1	3.4	4.0	5.1	4.8	4.4	3.8	3.9	3.6	1.9
ABAA11	Average	10.2	9.9	7.4	6.6	9.4	9.2	7.5	7.4	10.3	11.1	9.7	9.4
	Maximum	12.5	12.5	14.3	13.1	25.0	25.0	25.0	25.0	16.0	16.0	16.0	11.3
	Minimum	6.0	4.0	3.1	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.1	2.2	3.0	2.9	4.0	5.8	5.5	4.8	4.7	4.6	4.2	1.7
ABAA21	Average	10.2	10.0	7.5	6.6	9.8	9.7	7.6	7.7	9.9	10.1	9.0	9.2
	Maximum	12.5	12.5	14.3	13.2	25.0	25.0	25.0	25.0	16.0	16.0	16.0	11.3
	Minimum	6.0	6.0	4.5	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.2	2.1	3.1	2.9	4.1	6.2	5.5	5.0	4.4	4.6	3.9	1.8
GBBD21	Average	10.1	10.0	7.9	6.5	9.4	9.4	8.0	8.2	9.8	9.5	8.5	9.1
	Maximum	12.5	12.5	14.3	14.5	25.0	25.0	25.0	25.0	16.0	16.0	16.0	11.3
	Minimum	4.0	4.0	3.8	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	4.0
	Std. Deviation	2.3	2.2	3.1	2.8	4.4	6.7	5.8	5.1	4.4	4.2	3.7	1.8
GDAA21	Average	10.1	10.1	8.1	6.6	9.7	9.1	8.0	8.3	9.6	9.3	8.6	9.0
	Maximum	12.5	12.5	14.3	14.5	25.0	25.0	25.0	25.0	16.0	16.0	16.0	11.3
	Minimum	6.0	6.0	4.5	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.1	2.0	3.2	2.8	4.5	6.5	5.8	5.2	4.5	4.2	3.8	1.7
EBAE33	Average	9.7	9.5	8.5	7.8	9.9	13.5	8.2	6.9	8.8	7.9	7.1	8.9
	Maximum	12.5	12.5	14.3	16.0	16.0	25.0	26.3	19.6	22.0	20.5	16.0	11.3
	Minimum	6.0	6.0	4.5	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.4	2.2	3.6	3.6	4.1	7.3	5.0	3.1	4.7	4.7	3.5	2.0
EBAE82	Average	10.2	9.8	9.0	9.2	10.9	11.5	8.1	6.3	5.7	8.3	8.4	9.3
	Maximum	12.5	12.5	16.9	16.0	25.0	27.9	25.0	20.1	16.6	20.5	20.9	11.3
	Minimum	6.0	6.0	4.5	3.0	3.7	3.7	3.7	3.7	3.0	3.0	3.0	6.0
	Std. Deviation	2.2	2.1	3.7	4.9	5.0	7.2	5.3	3.3	3.1	4.8	4.1	1.9
EVQ2XX	Average	5.9	7.1	10.2	10.8	15.4	22.8	8.6	4.0	4.9	6.0	5.9	5.6
	Maximum	10.4	16.0	37.2	24.5	35.7	66.6	33.5	12.2	14.5	16.9	13.3	13.4
	Minimum	2.8	2.7	4.4	4.3	3.8	3.2	0.0	0.1	0.1	1.7	1.7	1.9
	Std. Deviation	1.7	2.4	5.0	4.2	6.9	13.7	7.0	2.7	2.6	2.2	2.0	1.8

Table 5-3. Flow statistics for Garrison Dam over the 96-year simulation period (in kcfs).

Alternative		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ABAA10	Average	21.7	21.9	20.9	21.9	22.2	21.7	23.2	21.6	31.5	26.1	18.4	19.5
	Maximum	27.5	30.0	36.2	42.0	42.0	60.0	60.0	42.0	42.0	42.0	42.0	22.5
	Minimum	12.0	12.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.6	6.5	8.4	9.5	8.1	11.4	13.0	9.2	10.7	9.9	5.8	3.4
ABAA20	Average	22.7	22.7	21.7	22.1	22.3	22.4	25.2	22.3	28.8	21.8	16.9	19.9
	Maximum	27.5	30.0	36.2	42.0	42.0	57.1	60.0	42.0	42.0	42.0	42.0	22.5
	Minimum	15.0	15.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.6	6.5	8.2	9.3	8.1	11.1	13.7	9.1	9.8	9.7	5.5	3.4
ABAA11	Average	21.3	20.8	19.2	20.4	24.1	22.2	24.3	21.1	30.1	27.3	20.6	19.3
	Maximum	27.5	30.0	36.2	44.2	46.9	60.0	60.0	56.5	60.0	42.0	42.0	22.5
	Minimum	12.0	12.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.2	5.2	6.7	11.6	10.1	12.2	16.5	11.4	11.3	10.2	7.9	3.2
ABAA21	Average	21.9	21.3	19.4	20.4	24.4	22.7	25.0	21.2	29.5	24.4	19.1	19.6
	Maximum	27.5	30.0	36.2	44.3	45.7	60.0	60.0	56.5	60.0	42.0	42.0	22.5
	Minimum	15.0	15.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.3	5.3	6.7	11.7	10.2	12.8	16.7	11.3	11.7	10.1	7.6	3.3
DDBB21	Average	22.4	21.9	20.9	19.5	23.5	22.6	25.7	21.1	29.0	23.6	18.9	19.7
	Maximum	27.5	30.0	36.2	44.3	45.7	60.0	60.0	56.3	60.0	42.0	37.3	22.5
	Minimum	12.0	12.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.1	4.9	6.6	11.4	10.5	13.4	17.6	11.5	11.2	9.8	7.0	3.2
GCAA21	Average	21.8	21.3	21.3	18.9	21.8	23.4	28.6	23.6	25.3	23.2	19.1	19.3
	Maximum	27.5	30.0	36.2	45.2	49.4	60.0	60.0	55.6	42.0	41.4	38.8	22.5
	Minimum	12.0	12.0	11.9	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.3	5.1	6.8	8.7	9.6	14.2	16.0	11.2	9.1	9.5	7.6	3.3
DBAE71	Average	21.6	20.2	23.5	24.4	26.7	29.3	26.0	21.3	24.4	20.6	12.4	18.5
	Maximum	27.5	30.0	36.2	53.9	58.1	60.0	60.0	60.0	42.0	42.0	28.6	22.5
	Minimum	12.0	12.0	10.0	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	12.0
	Std. Deviation	5.7	5.3	9.3	14.2	13.2	13.1	15.4	11.2	11.7	11.3	4.1	3.5
ABAE93	Average	19.9	19.1	22.6	29.1	31.4	31.4	22.4	19.3	26.8	18.6	12.0	17.5
	Maximum	27.5	30.0	36.2	60.0	60.0	60.0	60.0	60.0	42.0	42.0	31.0	22.5
	Minimum	15.0	15.0	12.4	10.0	11.2	11.2	11.2	11.2	10.0	10.0	10.0	15.0
	Std. Deviation	5.7	5.3	10.2	17.3	15.9	11.9	12.9	8.7	13.0	11.2	3.9	3.4
EVQ2XX	Average	10.8	13.8	27.1	29.1	33.9	64.7	31.8	10.7	11.2	14.1	12.3	9.8
	Maximum	17.7	32.5	76.2	105.0	76.1	129.5	92.1	28.8	26.9	36.9	20.9	20.5
	Minimum	5.4	5.8	11.7	8.0	7.6	16.1	0.1	0.1	0.1	1.3	3.4	3.5

Table 5-4. Flow statistics for Fort Randall Dam over the 96-year simulation period (in kcfs).

Alternative		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ABAA10	Average	14.5	13.6	16.5	25.7	27.5	28.2	31.7	35.2	35.4	33.5	29.7	16.4
	Maximum	19.0	18.9	24.6	41.9	45.9	53.6	55.1	61.0	64.9	64.2	70.8	26.7
	Minimum	8.4	7.0	5.1	5.0	5.0	5.0	10.1	8.6	6.7	5.5	5.8	8.8
	Std. Deviation	3.1	3.1	4.2	8.5	7.9	8.8	8.9	10.6	11.1	13.4	11.6	4.9
ABAA20	Average	14.7	13.8	16.3	25.7	27.7	28.7	31.9	36.0	35.3	31.3	26.6	16.9
	Maximum	19.0	18.9	24.3	41.9	45.9	54.2	55.1	61.1	64.9	64.2	70.8	26.7
	Minimum	8.4	5.9	5.0	5.0	5.0	5.0	11.3	15.6	17.8	5.0	5.0	8.8
	Std. Deviation	3.2	3.3	4.4	8.1	7.8	9.2	8.8	10.9	11.4	16.3	14.9	5.1
ABAA11	Average	13.8	13.0	17.0	26.5	27.6	27.5	31.9	35.4	35.7	33.9	29.9	15.5
	Maximum	16.0	16.0	24.6	40.9	44.8	51.1	58.2	63.3	64.8	64.1	70.6	24.1
	Minimum	8.4	7.0	5.1	5.0	5.0	5.0	10.1	8.6	6.7	5.5	5.8	8.8
	Std. Deviation	2.3	2.5	4.4	8.5	7.6	8.0	9.3	10.8	11.3	13.6	11.8	3.9
ABAA21	Average	13.7	13.0	17.0	27.1	28.3	28.0	32.3	35.9	35.6	31.7	26.5	15.7
	Maximum	16.0	16.0	23.6	40.9	44.6	52.4	58.2	63.5	64.8	64.1	70.6	24.1
	Minimum	8.4	5.9	5.0	5.0	5.0	5.0	11.3	15.6	17.8	5.0	5.0	8.8
	Std. Deviation	2.5	2.7	4.3	8.2	7.1	8.1	8.9	11.0	11.6	16.5	15.3	4.2
ADDE21	Average	16.2	15.0	17.3	25.1	27.4	27.5	31.8	35.0	33.6	32.2	28.2	17.7
	Maximum	18.1	17.3	24.0	40.8	43.5	52.4	58.2	63.3	64.8	64.1	70.6	24.1
	Minimum	13.3	11.9	5.6	5.0	5.0	5.0	11.9	15.7	12.2	11.5	12.6	14.7
	Std. Deviation	0.9	0.9	4.1	9.0	7.2	8.2	9.1	11.1	13.3	14.7	12.5	2.1
GDAA21	Average	16.3	15.2	16.8	23.3	24.9	25.6	30.7	36.4	35.4	32.8	27.4	18.1
	Maximum	18.8	18.4	25.1	40.8	46.5	52.4	58.2	63.6	64.8	64.1	70.6	24.1
	Minimum	12.6	12.4	6.1	5.0	5.0	5.0	6.0	7.9	6.4	5.0	5.0	14.0
	Std. Deviation	1.1	1.2	5.2	11.9	11.3	11.9	13.2	15.3	14.6	17.2	15.7	2.1
EBAE83	Average	14.1	13.0	21.7	36.1	41.8	34.4	27.8	19.3	18.3	33.7	27.7	15.5
	Maximum	19.0	18.3	36.1	59.3	57.8	52.6	46.5	36.1	46.0	63.2	66.2	25.1
	Minimum	8.4	5.4	5.5	6.0	6.0	6.0	6.0	13.9	6.1	6.0	6.0	6.5
	Std. Deviation	3.4	3.4	10.5	23.1	16.3	11.0	7.1	4.7	10.9	19.4	15.7	5.0
ABAE92	Average	14.1	13.0	21.6	39.5	40.0	33.8	28.5	29.1	31.1	23.3	16.6	15.0
	Maximum	19.0	18.9	33.5	57.3	56.5	49.8	45.3	48.7	61.4	61.2	45.5	23.1
	Minimum	6.6	5.9	6.8	12.4	9.4	12.9	13.8	21.1	16.7	5.0	5.0	8.1
	Std. Deviation	3.8	3.7	6.5	10.6	11.2	7.9	5.5	5.9	10.5	15.8	10.9	4.7
EVQ2XX	Average	11.5	15.9	39.7	39.1	39.7	72.9	31.8	9.1	11.5	14.0	12.2	9.3
	Maximum	19.7	40.7	126.5	192.0	91.9	151.7	100.2	29.9	32.9	48.2	33.1	25.6
	Minimum	4.7	5.5	12.3	8.4	10.6	17.3	0.1	0.1	0.1	0.1	0.2	0.5
	Std. Deviation	3.7	5.8	18.8	25.3	17.0	32.1	21.8	6.8	8.1	7.5	5.9	4.8

Table 5-5. Flow statistics for Gavins Point Dam over the 96-year simulation period (in kcfs).

Alternative		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ABAA10	Average	16.0	15.8	19.8	28.5	30.1	30.7	32.9	36.2	37.0	35.5	31.6	17.9
	Maximum	20.0	20.0	27.6	45.0	49.8	55.7	57.7	63.4	66.4	66.3	72.8	28.3
	Minimum	10.6	9.3	9.1	7.9	7.0	10.4	10.1	9.0	8.7	7.0	7.3	10.1
	Std. Deviation	3.1	3.1	3.6	7.9	7.5	8.4	8.8	10.7	11.0	13.4	11.6	5.0
ABAA20	Average	16.2	15.9	19.6	28.5	30.4	31.2	33.2	37.0	36.8	33.3	28.5	18.4
	Maximum	20.0	20.0	26.8	44.2	49.8	56.4	57.7	63.9	66.4	66.3	72.8	28.3
	Minimum	10.6	9.3	11.2	8.5	10.4	11.3	16.2	17.4	19.5	7.0	7.2	10.1
	Std. Deviation	3.2	3.3	3.7	7.6	7.4	8.8	8.7	11.0	11.3	16.2	14.8	5.1
ABAA11	Average	15.3	15.2	20.3	29.3	30.3	30.1	33.1	36.4	37.2	35.8	31.8	17.0
	Maximum	17.0	17.0	27.6	44.5	48.6	53.2	59.0	64.4	66.3	66.2	72.6	25.7
	Minimum	10.6	9.3	9.1	7.9	7.0	10.4	10.1	9.0	8.7	7.0	7.3	10.1
	Std. Deviation	2.3	2.5	3.8	7.9	7.1	7.6	9.1	10.9	11.2	13.6	11.8	4.0
ABAA21	Average	15.3	15.1	20.4	29.9	31.0	30.5	33.5	36.9	37.2	33.6	28.4	17.2
	Maximum	17.0	17.0	26.1	44.3	48.5	54.6	59.0	64.5	66.3	66.2	72.6	25.7
	Minimum	10.6	9.3	11.2	8.5	10.4	11.3	16.2	17.4	19.5	7.0	7.2	10.1
	Std. Deviation	2.5	2.7	3.6	7.6	6.6	7.8	8.9	11.1	11.5	16.5	15.3	4.2
BDDD21	Average	17.7	17.2	20.8	28.4	29.6	29.4	32.5	35.7	35.6	34.2	30.4	19.2
	Maximum	19.5	18.3	26.4	43.3	47.4	54.6	59.0	64.4	66.3	66.2	72.6	25.7
	Minimum	16.6	15.3	11.7	9.5	10.4	12.3	14.8	12.5	13.8	13.8	14.9	16.1
	Std. Deviation	0.6	0.5	3.3	8.4	7.4	8.3	9.7	12.0	12.8	14.6	12.3	2.0
GDAA21	Average	17.9	17.3	20.2	26.2	27.6	28.2	31.9	37.4	36.9	34.7	29.3	19.6
	Maximum	20.0	20.0	27.4	43.6	51.1	54.6	59.0	64.6	66.3	66.2	72.6	25.7
	Minimum	15.9	14.8	10.8	7.4	7.0	9.2	6.4	9.9	7.9	7.2	7.0	15.9
	Std. Deviation	0.8	0.8	4.7	11.6	11.3	11.9	13.3	15.4	14.5	17.1	15.6	2.0
ABAE51	Average	15.8	15.4	22.8	37.1	37.1	34.8	30.3	30.7	34.6	30.8	23.5	17.0
	Maximum	20.0	20.0	30.9	57.8	58.8	52.2	48.6	50.4	62.3	62.8	48.5	24.4
	Minimum	9.9	9.3	12.2	16.7	16.1	10.4	18.1	21.3	19.5	7.0	7.2	9.9
	Std. Deviation	3.5	3.5	4.9	7.5	8.0	7.4	6.1	6.5	10.7	15.2	11.4	4.7
EBAE63	Average	16.5	16.1	26.0	40.6	44.7	35.2	27.3	19.9	21.6	34.3	28.2	17.7
	Maximum	20.0	20.0	39.1	62.0	62.0	54.6	49.3	37.5	46.6	65.0	64.2	26.6
	Minimum	10.6	9.3	8.4	7.9	10.3	8.9	11.2	16.3	9.0	7.5	7.6	10.1
	Std. Deviation	3.2	3.1	9.4	19.9	15.2	10.9	5.7	4.8	9.8	17.1	12.6	4.3
EVQ2XX	Average	13.0	18.0	43.1	41.9	42.4	75.5	33.0	10.1	13.0	16.0	14.1	10.8
	Maximum	22.6	43.7	135.2	195.7	94.5	154.3	101.3	31.7	34.4	50.2	34.9	26.9
	Minimum	5.9	7.0	15.1	9.8	12.7	20.5	0.0	0.0	0.5	1.6	1.7	1.7

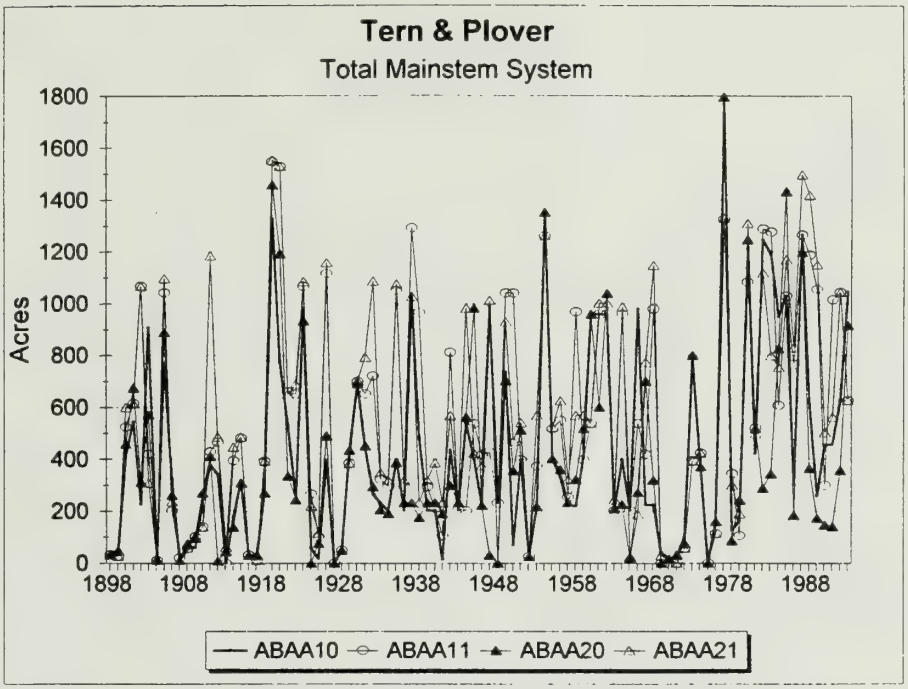

Figure 5-1. Average annual tern and plover habitat acreage for the entire river for four alternatives (1898 to 1993).

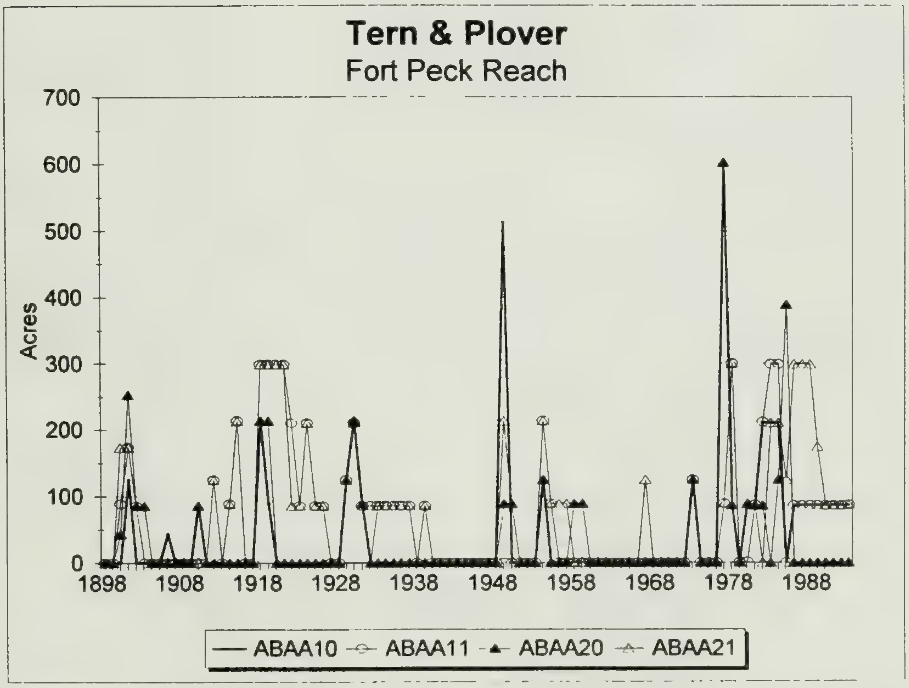

Figure 5-2. Average annual tern and plover habitat acreage in Fort Peck reach for four alternatives (1898 to 1993).

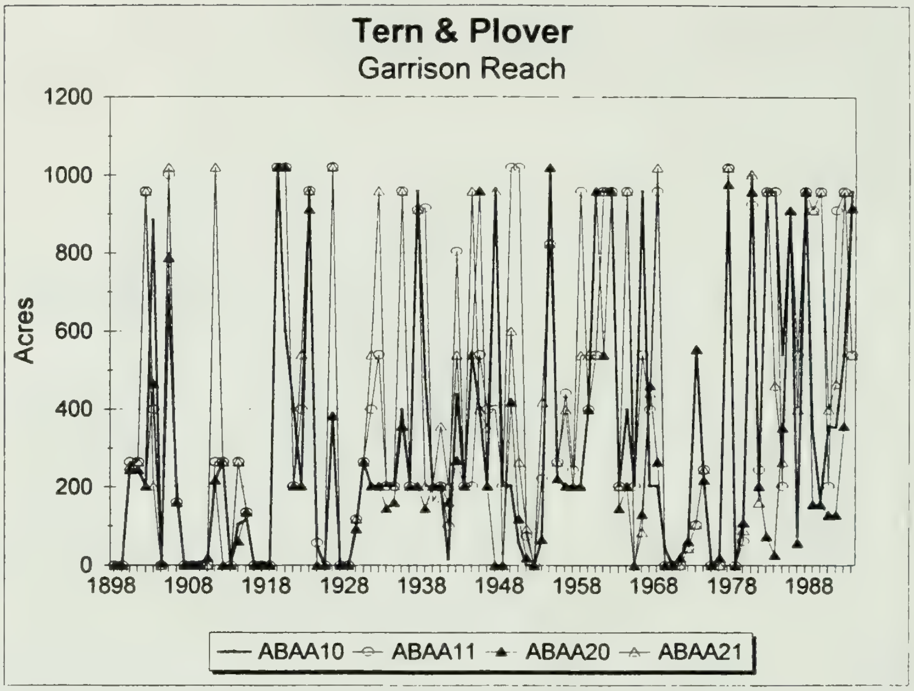

Figure 5-3. Average annual tern and plover habitat acreage in Garrison reach for four alternatives (1898 to 1993).

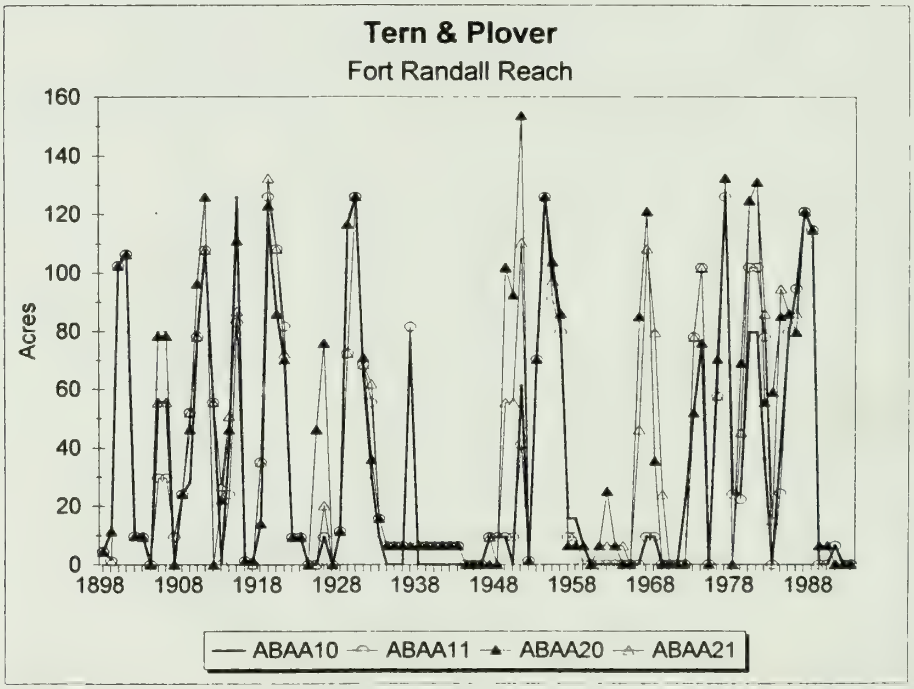

Figure 5-4. Average annual tern and plover habitat acreage in Fort Randall reach for four alternatives (1898 to 1993).

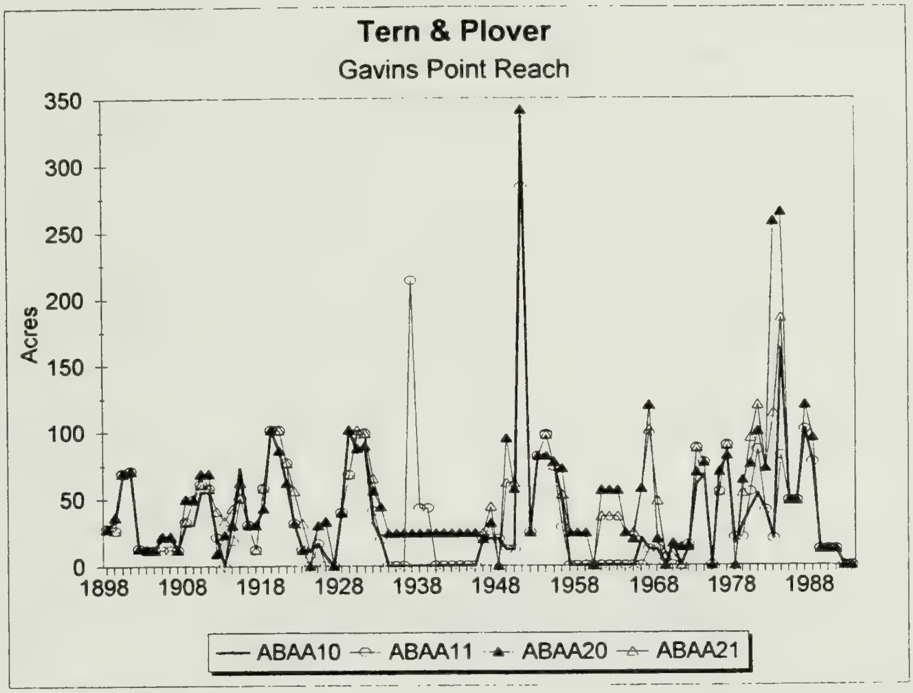

Figure 5-5. Average annual tern and plover habitat acreage in Gavins Point reach for four alternatives (1898 to 1993).

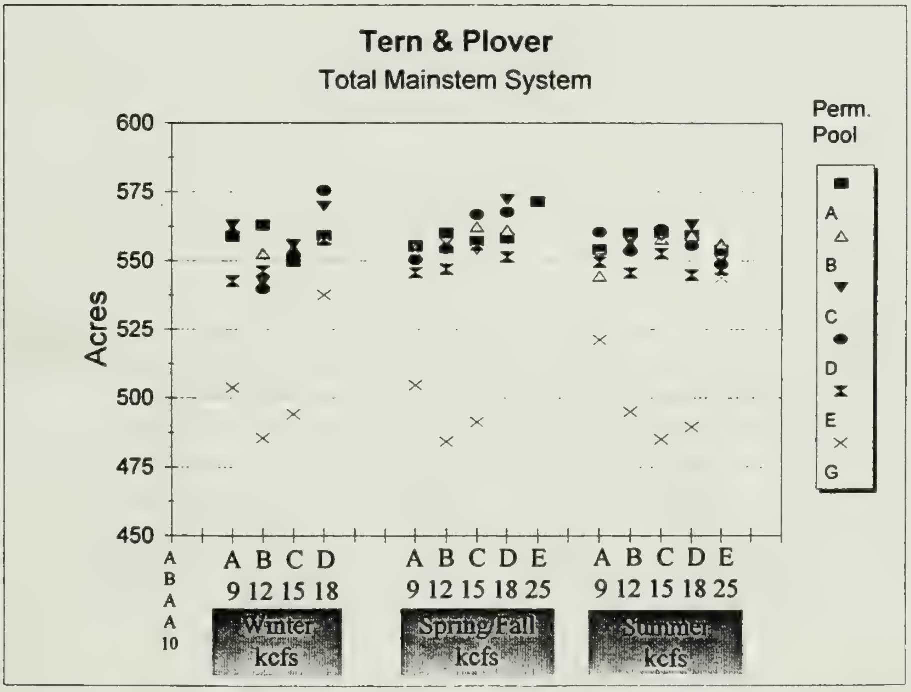

Figure 5-6. Mean tern and plover nesting habitat acreage for the Basic Set of alternatives for the entire river grouped by permanent pool level and nonnavigation season flows.

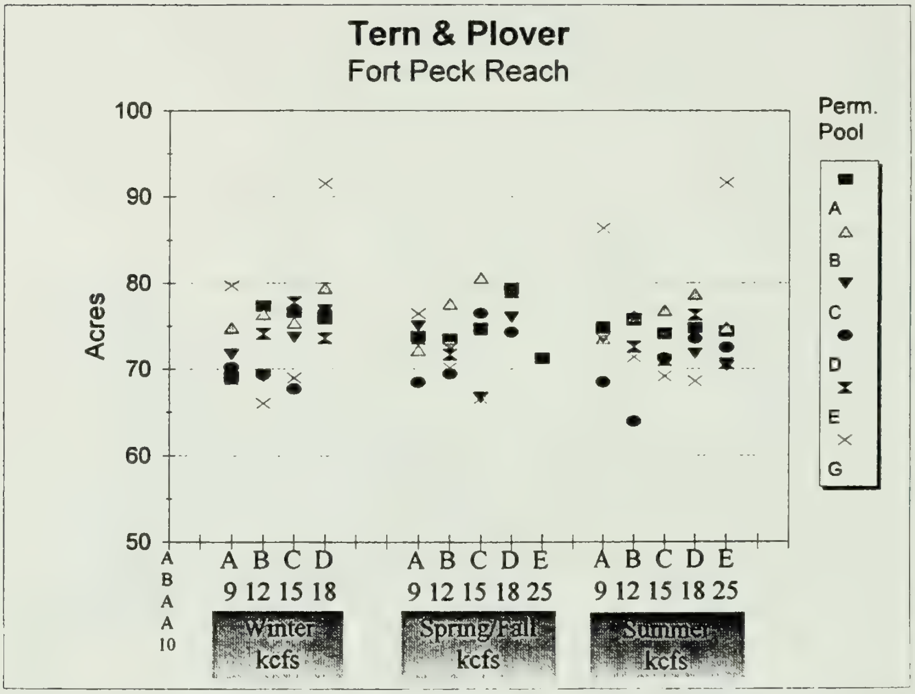

Figure 5-7. Mean tern and plover nesting habitat acreage for the Basic Set of alternatives for the Fort Peck reach grouped by permanent pool level and nonnavigation season flows.

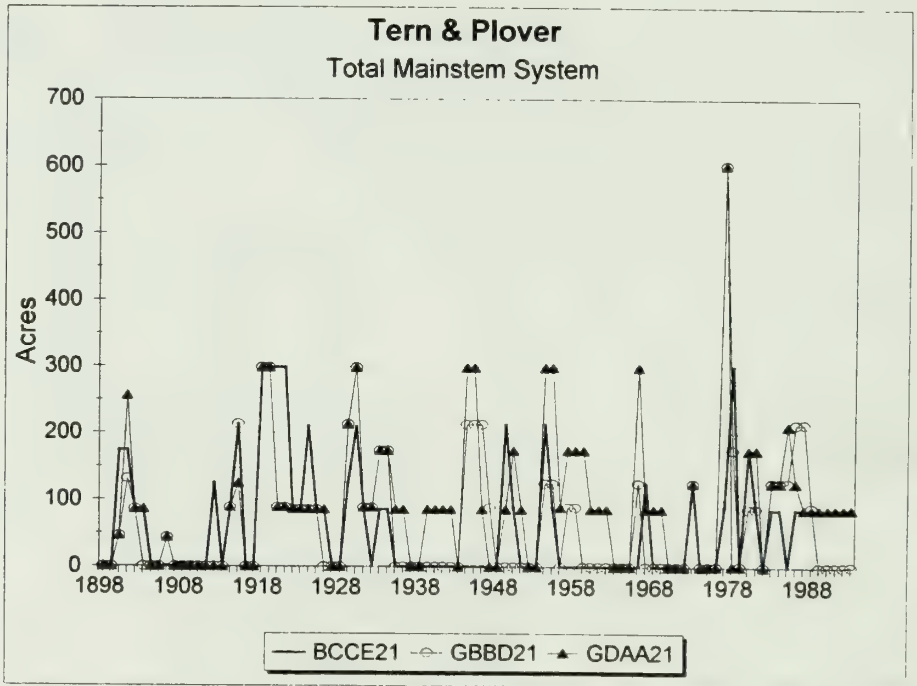

Figure 5-8. Time series of annual tern and plover habitat acreage in the Fort Peck reach for selected alternatives in the Basic Set of alternatives.

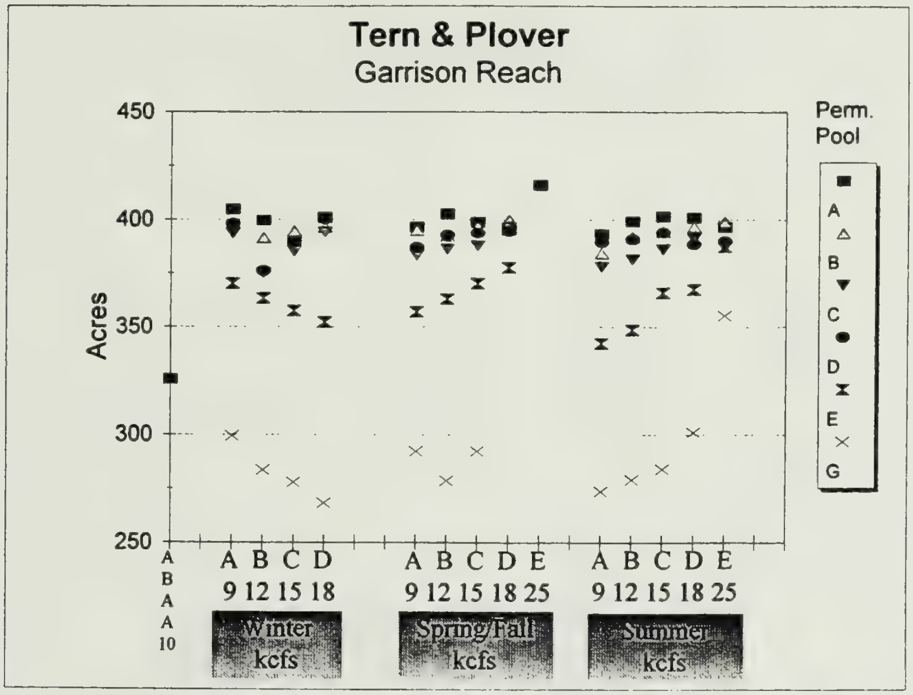

Figure 5-9. Mean tern and plover nesting habitat acreage for the Basic Set of alternatives for Garrison reach grouped by permanent pool level and nonnavigation season flows.

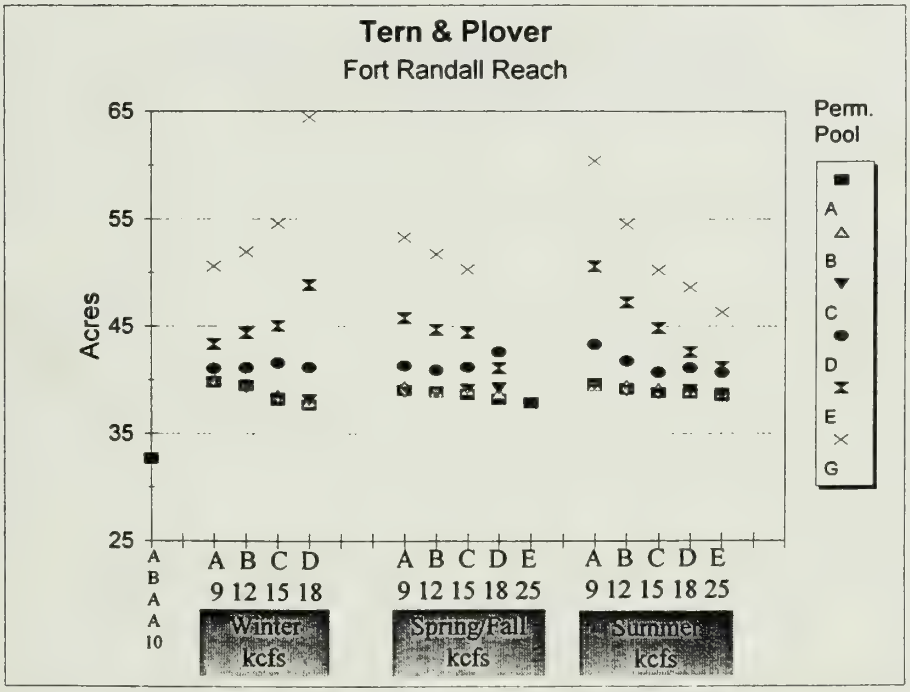

Figure 5-10. Mean tern and plover nesting habitat acreage for the Basic Set of alternatives for Fort Randall reach grouped by permanent pool level and nonnavigation season flows.

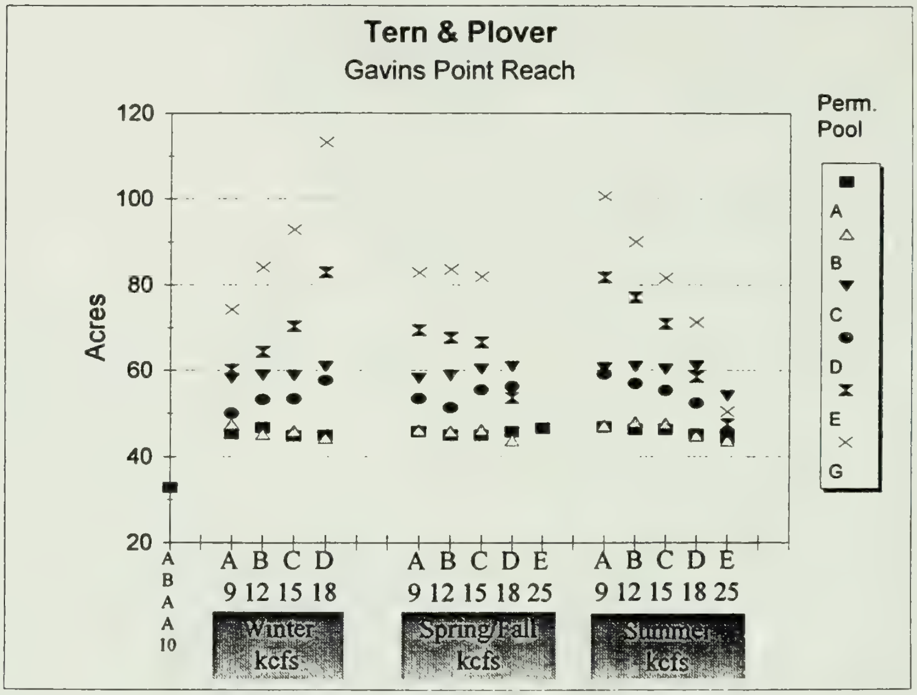

Figure 5-11. Mean tern and plover nesting habitat acreage for the Basic Set of alternatives for Gavins Point reach grouped by permanent pool level and nonnavigation season flows.

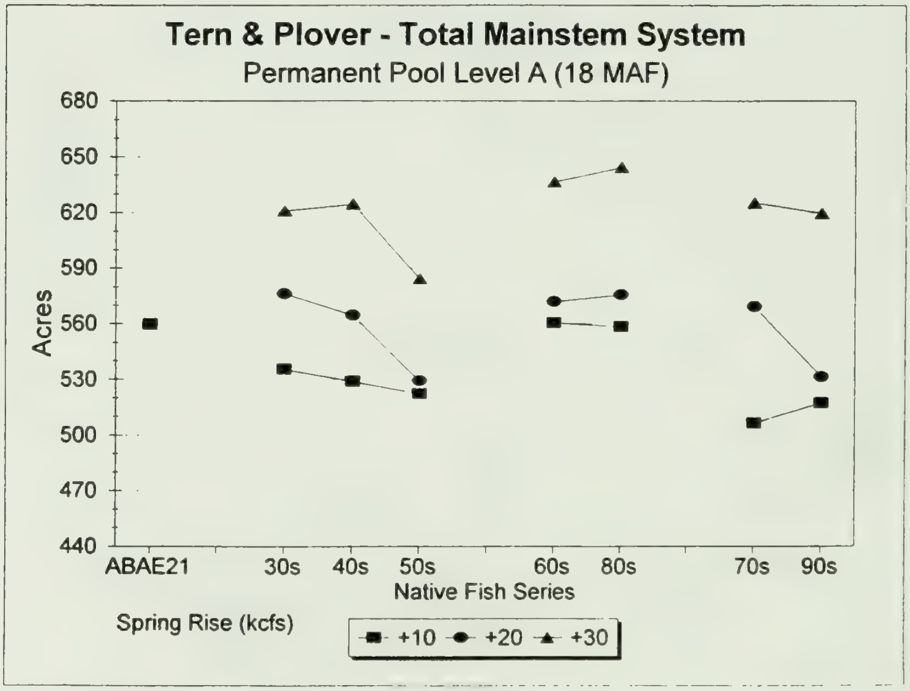

Figure 5-12. Mean tern and plover habitat under Native Fish alternatives for the entire river—18-MAF permanent pool level.

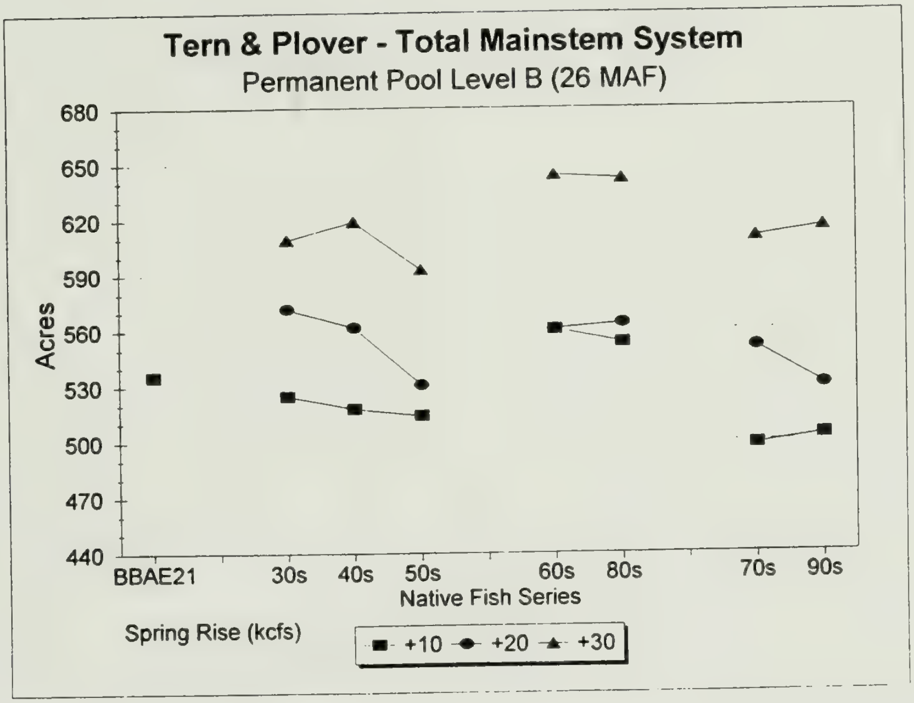

Figure 5-13. Mean tern and plover habitat under Native Fish alternatives for the entire river—26-MAF permanent pool level.

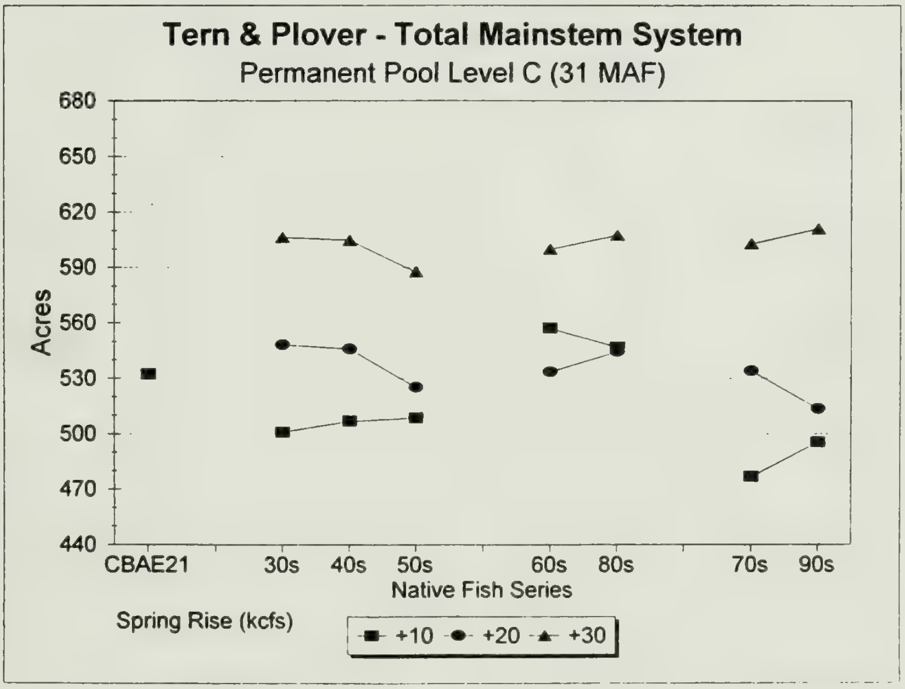

Figure 5-14. Mean tern and plover habitat under Native Fish alternatives for the entire river—31-MAF permanent pool level.

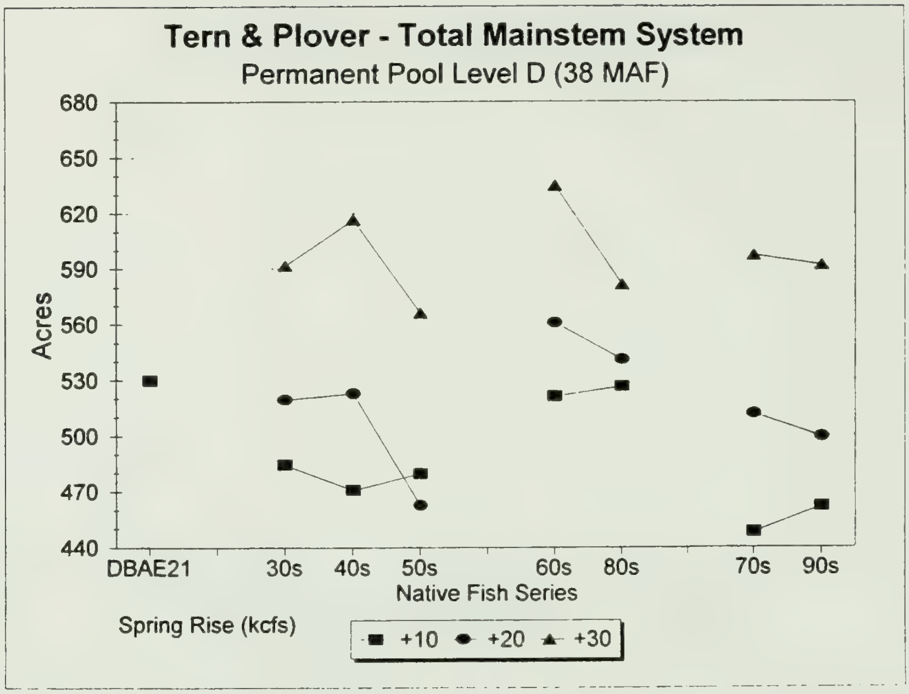

Figure 5-15. Mean tern and plover habitat under Native Fish alternatives for the entire river—38-MAF permanent pool level.

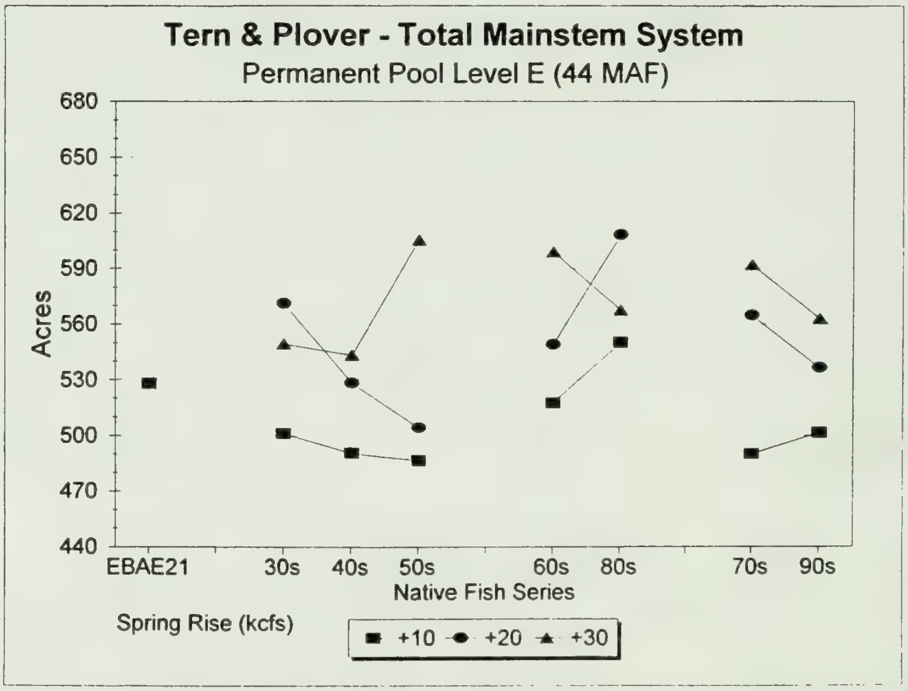

Figure 5-16. Mean tern and plover habitat under Native Fish alternatives for the entire river—44-MAF permanent pool level.

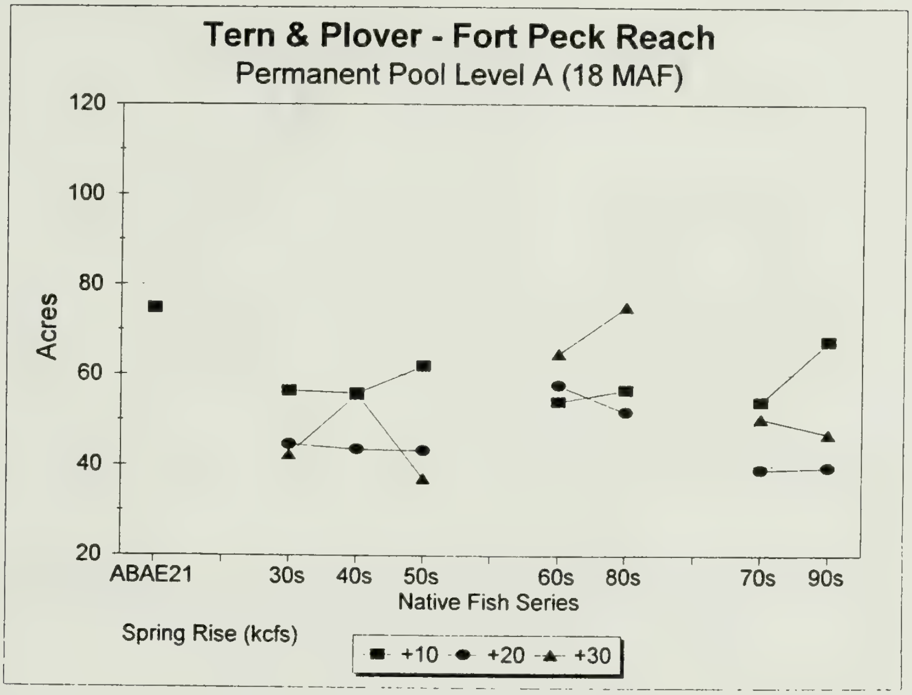

Figure 5-17. Mean tern and plover habitat under Native Fish alternatives for Fort Peck reach—18-MAF permanent pool level.

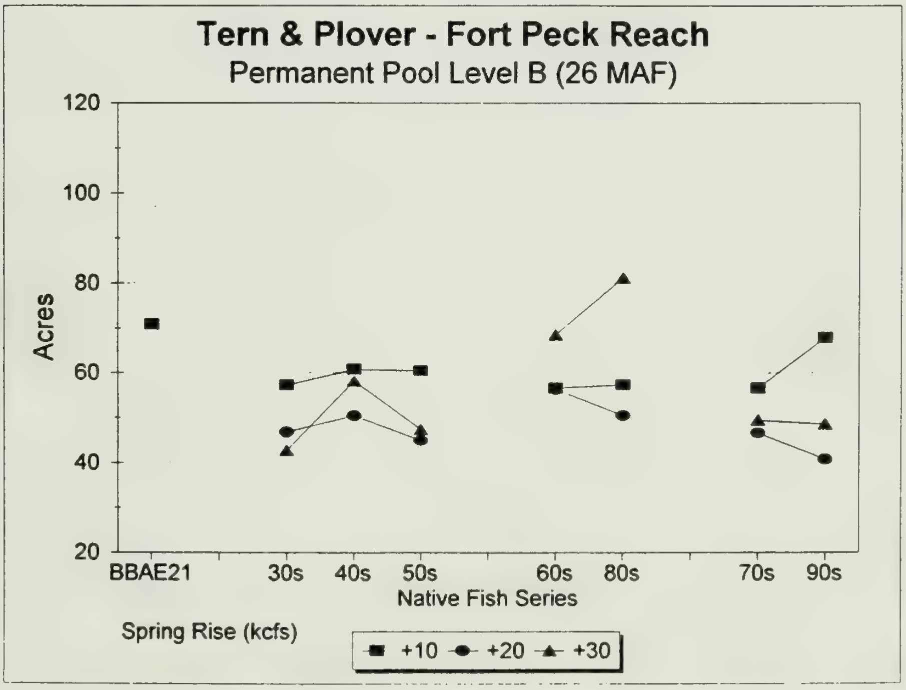

Figure 5-18. Mean tern and plover habitat under Native Fish alternatives for Fort Peck reach—26-MAF permanent pool level.

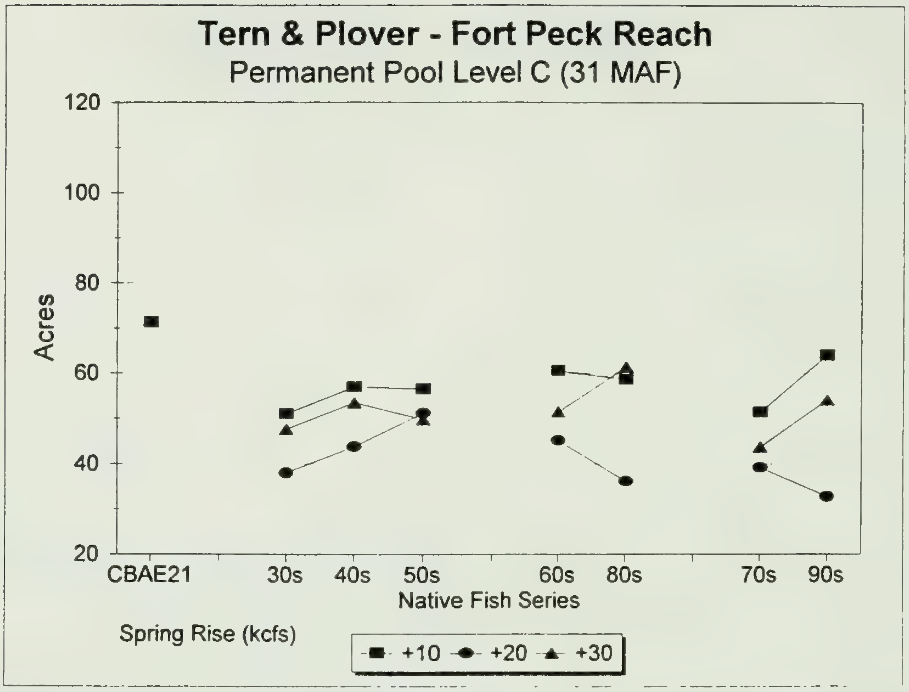

Figure 5-19. Mean tern and plover habitat under Native Fish alternatives for Fort Peck reach—31-MAF permanent pool level.

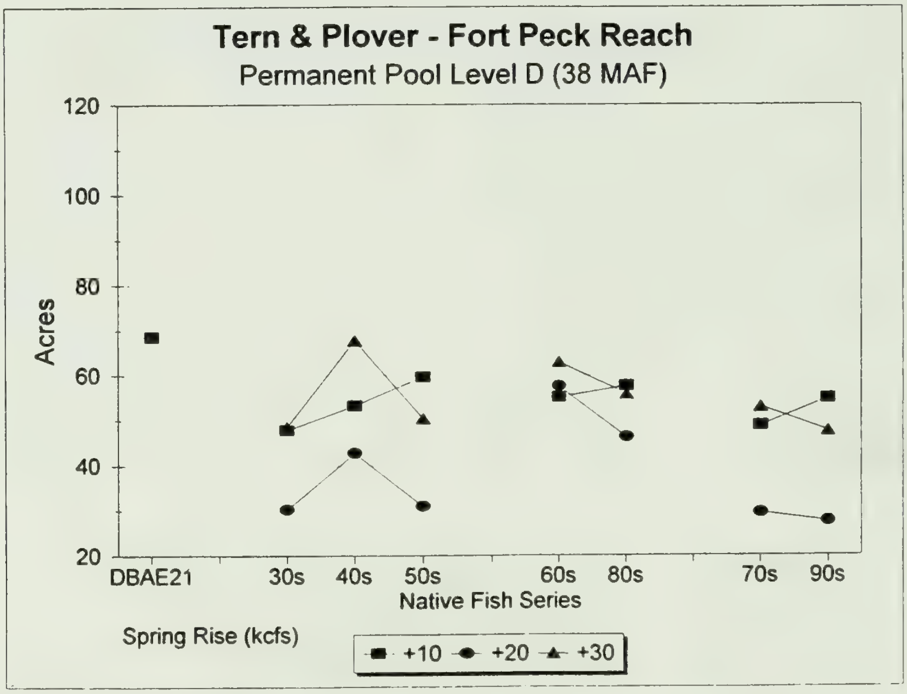

Figure 5-20. Mean tern and plover habitat under Native Fish alternatives for Fort Peck reach—38-MAF permanent pool level.

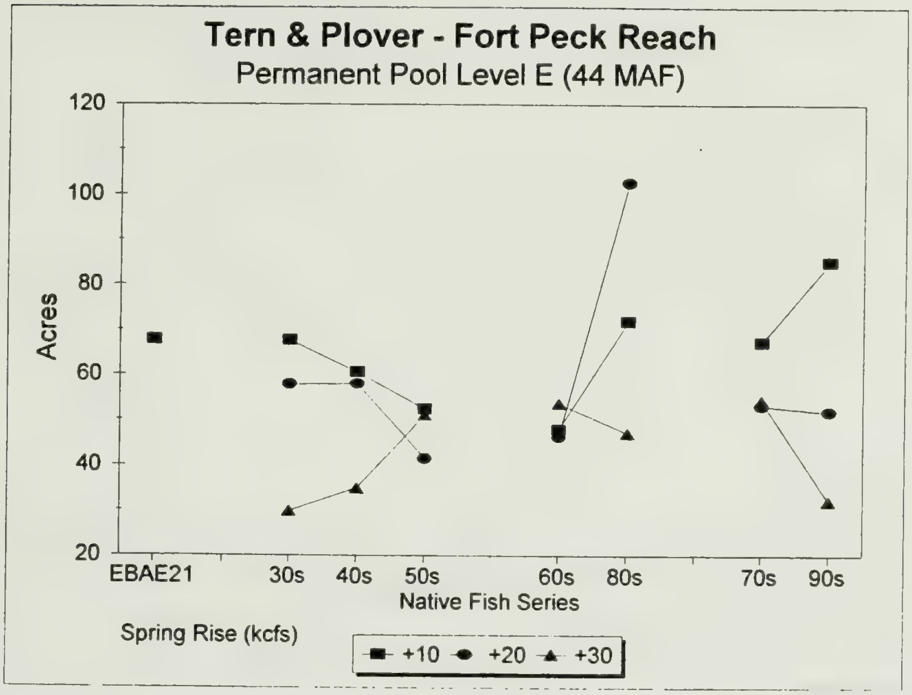

Figure 5-21. Mean tern and plover habitat under Native Fish alternatives for Fort Peck reach—44-MAF permanent pool level.

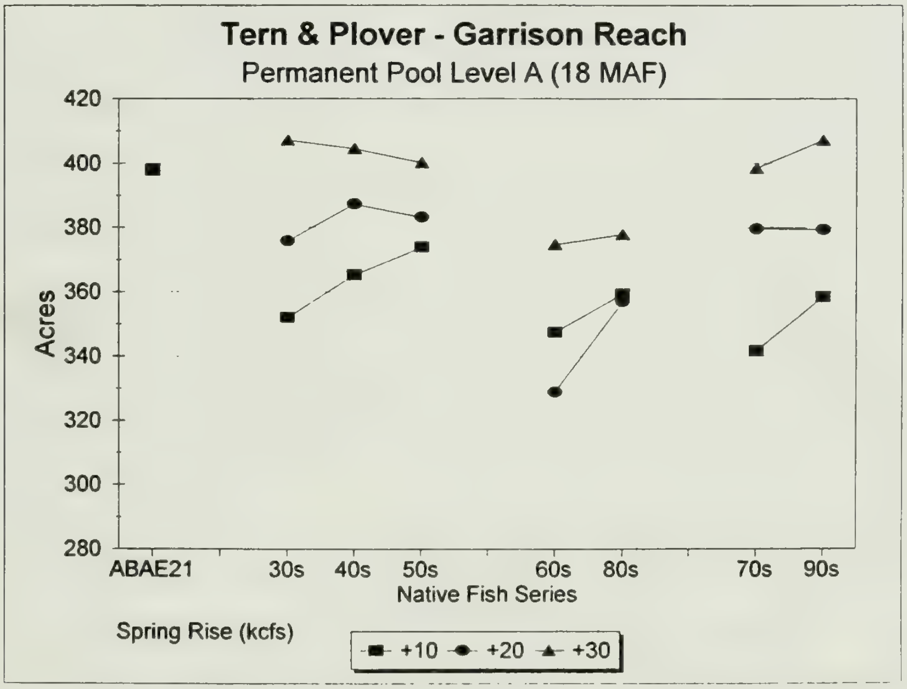

Figure 5-22. Mean tern and plover habitat under Native Fish alternatives for Garrison reach—18-MAF permanent pool level.

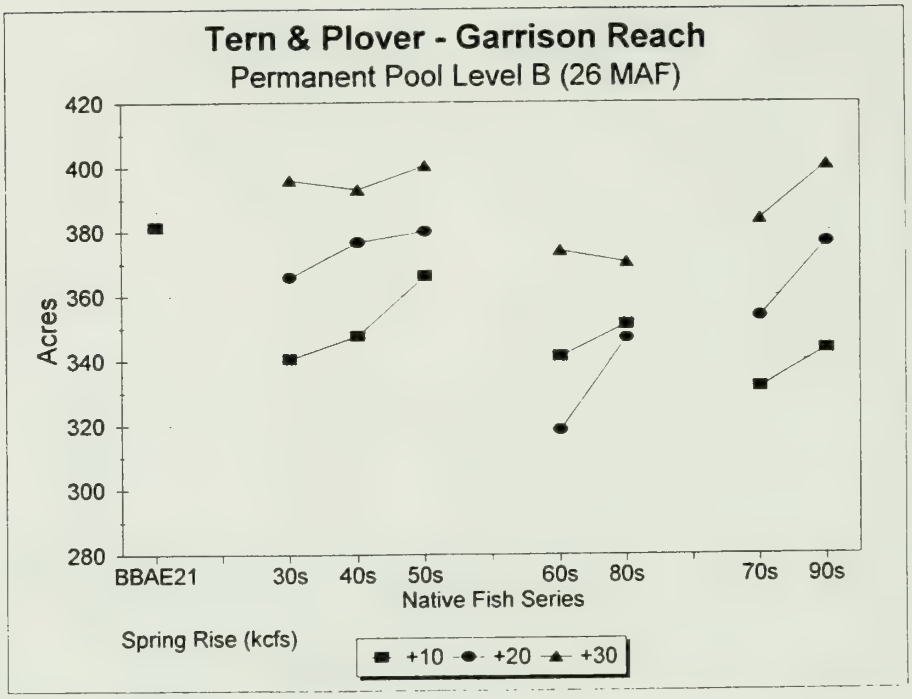

Figure 5-23. Mean tern and plover habitat under Native Fish alternatives for Garrison reach—26-MAF permanent pool level.

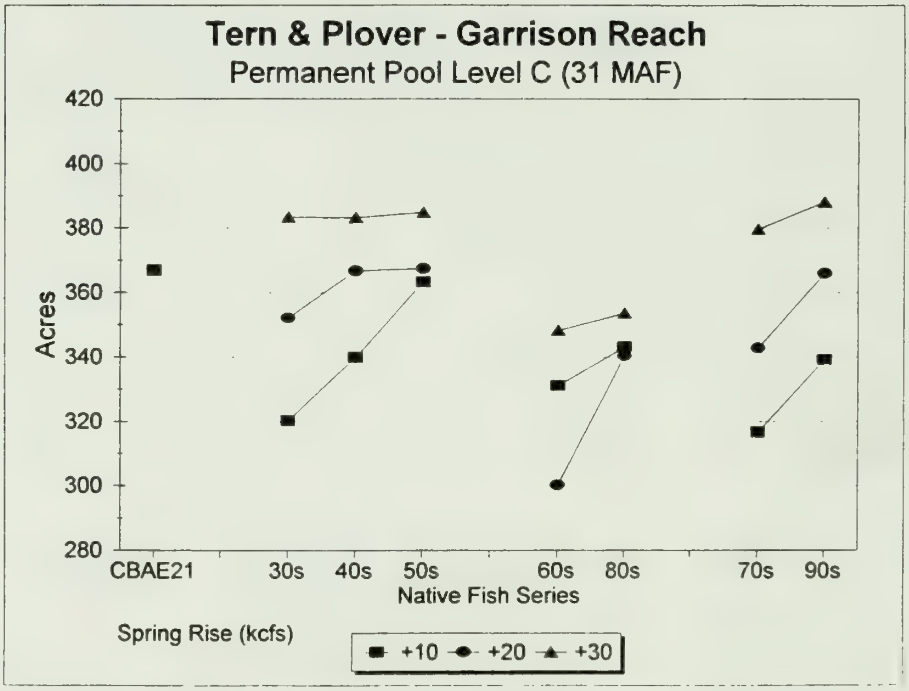

Figure 5-24. Mean tern and plover habitat under Native Fish alternatives for Garrison reach—31-MAF permanent pool level.

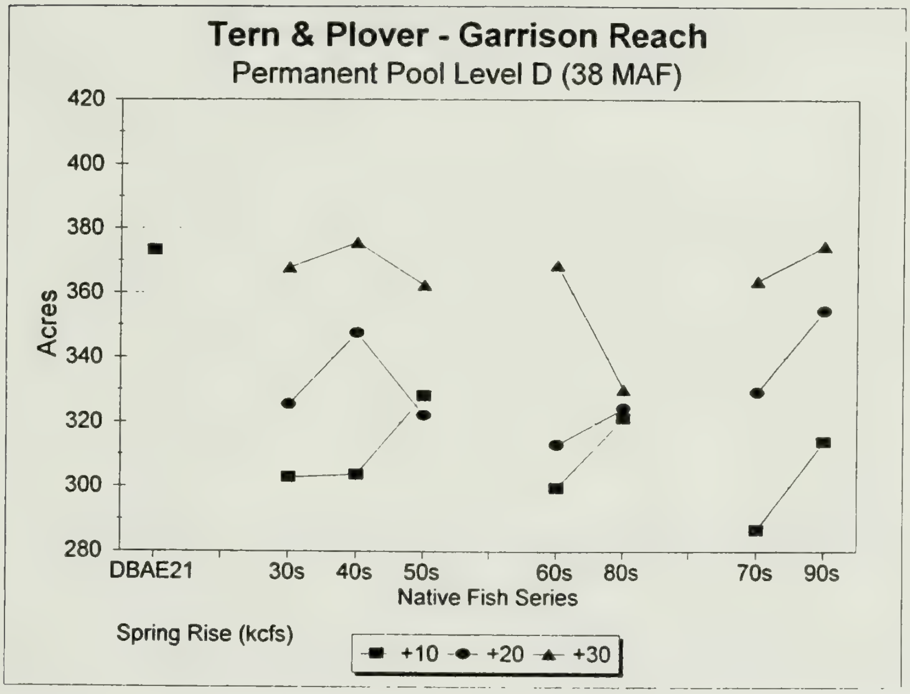

Figure 5-25. Mean tern and plover habitat under Native Fish alternatives for Garrison reach—38-MAF permanent pool level.

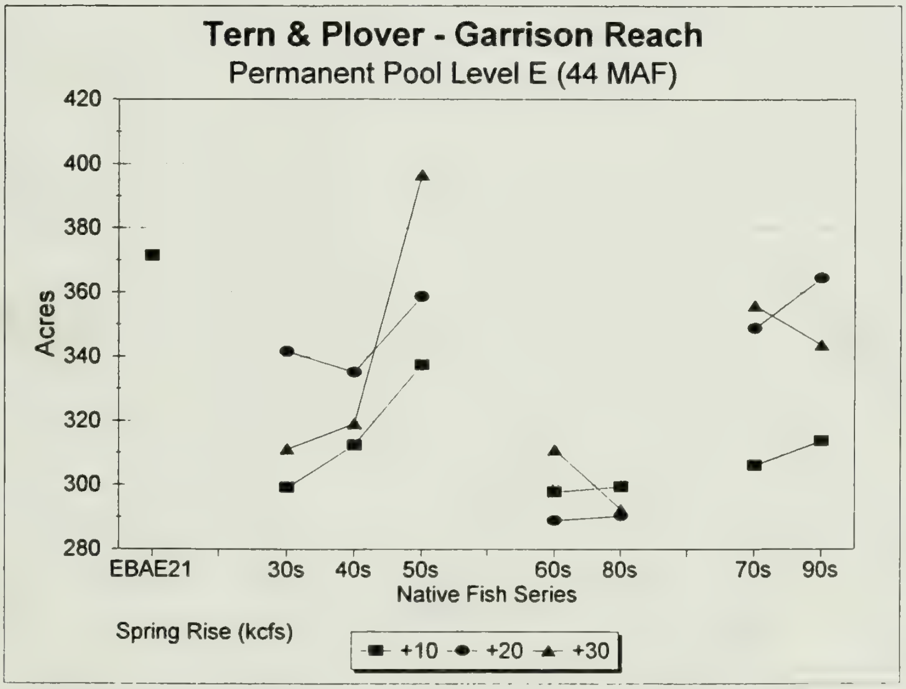

Figure 5-26. Mean tern and plover habitat under Native Fish alternatives for Garrison reach—44-MAF permanent pool level.

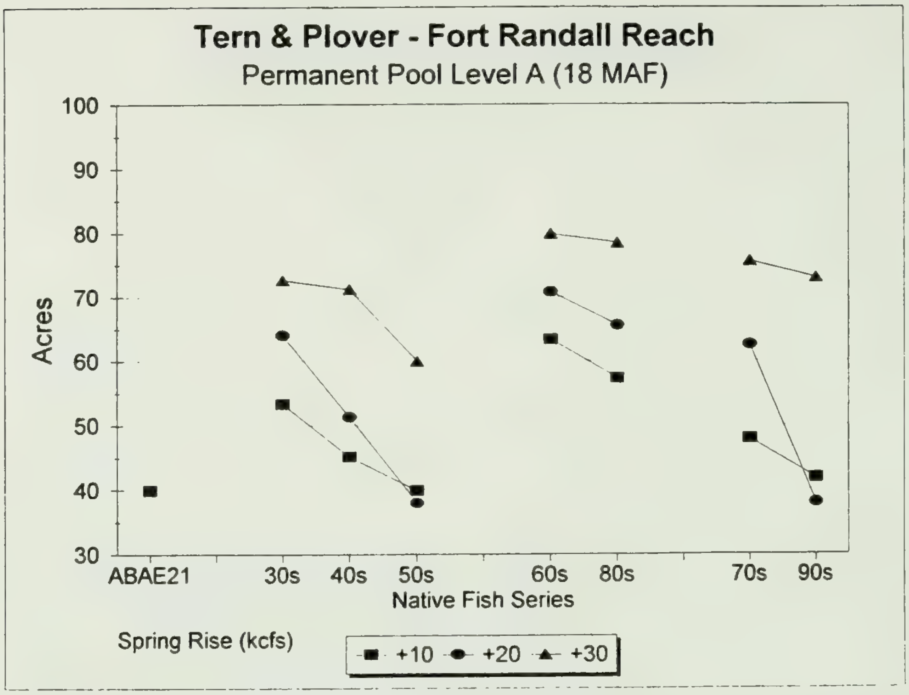

Figure 5-27. Mean tern and plover habitat under Native Fish alternatives for Fort Randall reach—18-MAF permanent pool level.

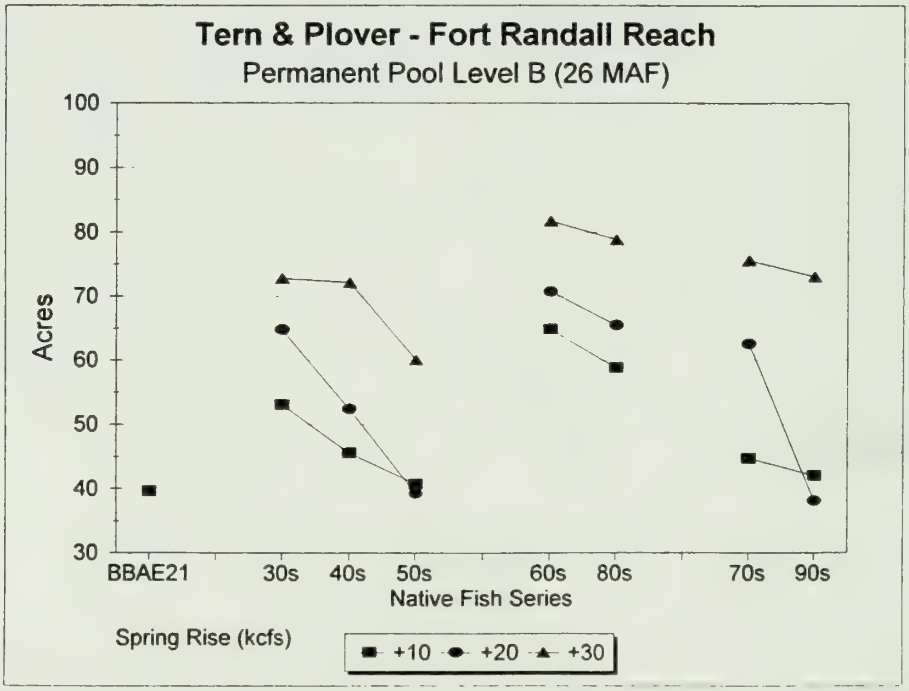

Figure 5-28. Mean tern and plover habitat under Native Fish alternatives for Fort Randall reach—26-MAF permanent pool level.

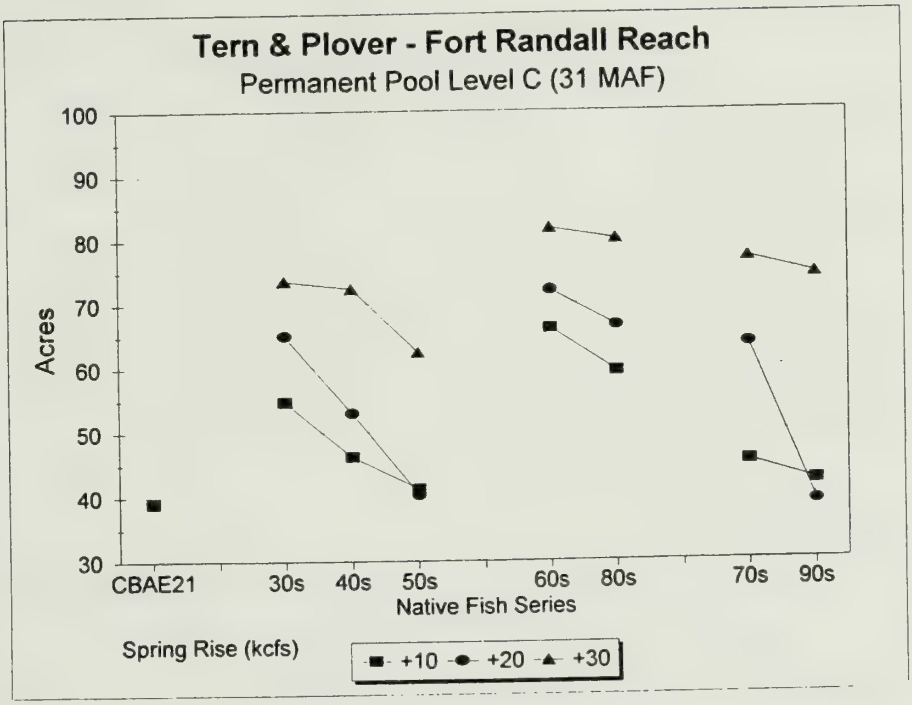

Figure 5-29. Mean tern and plover habitat under Native Fish alternatives for Fort Randall reach—31-MAF permanent pool level.

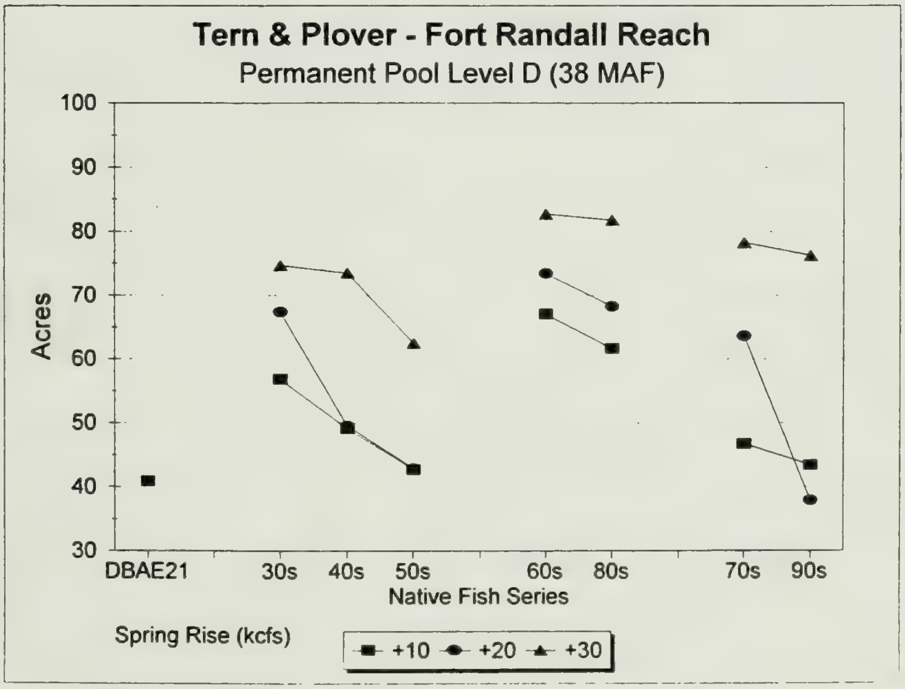

Figure 5-30. Mean tern and plover habitat under Native Fish alternatives for Fort Randall reach—38-MAF permanent pool level.

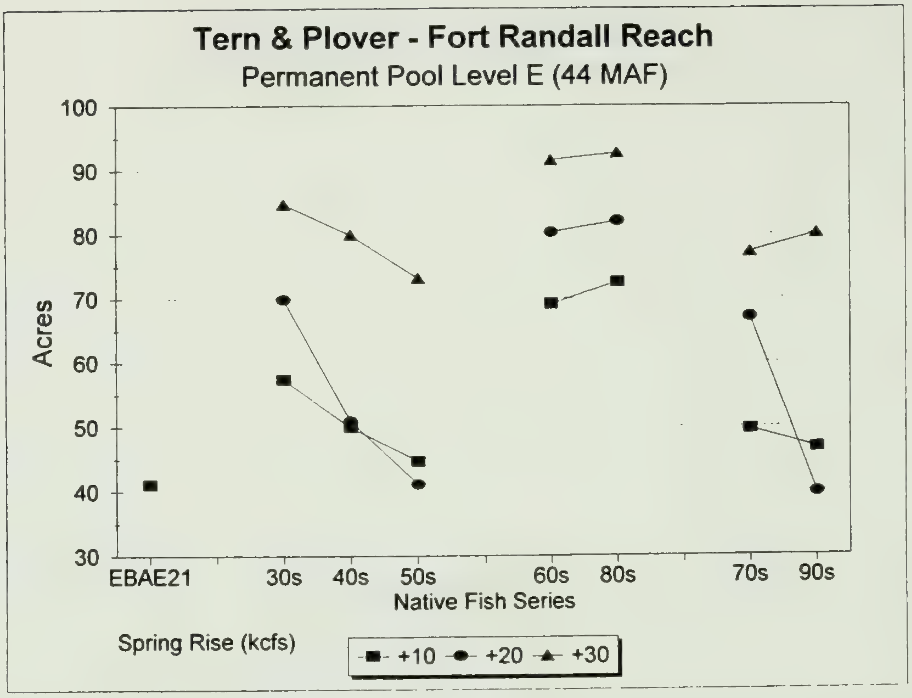

Figure 5-31. Mean tern and plover habitat under Native Fish alternatives for Fort Randall reach—44-MAF permanent pool level.

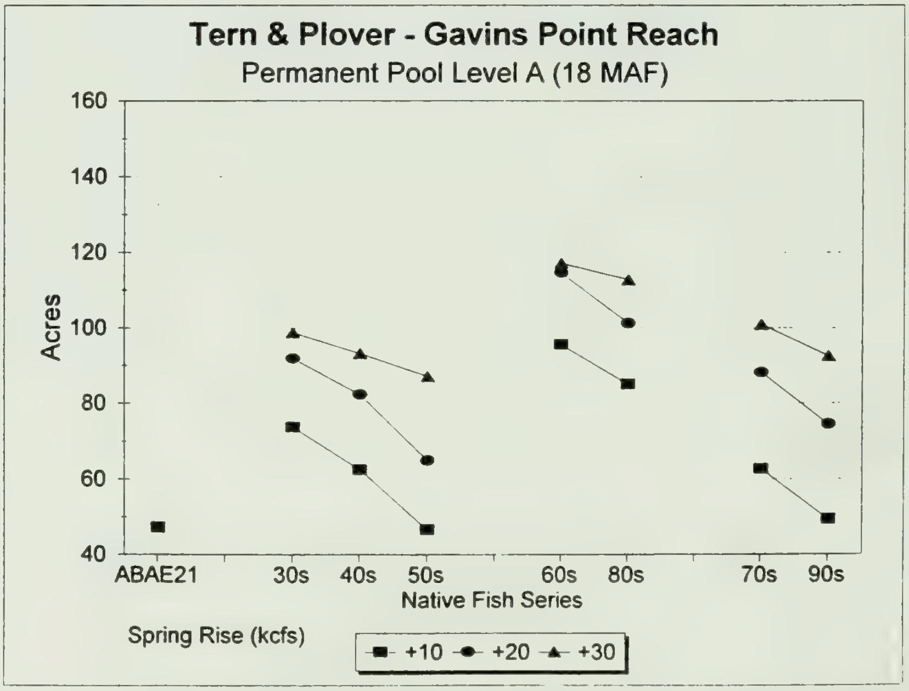

Figure 5-32. Mean tern and plover habitat under Native Fish alternatives for Gavins Point reach—18-MAF permanent pool level.

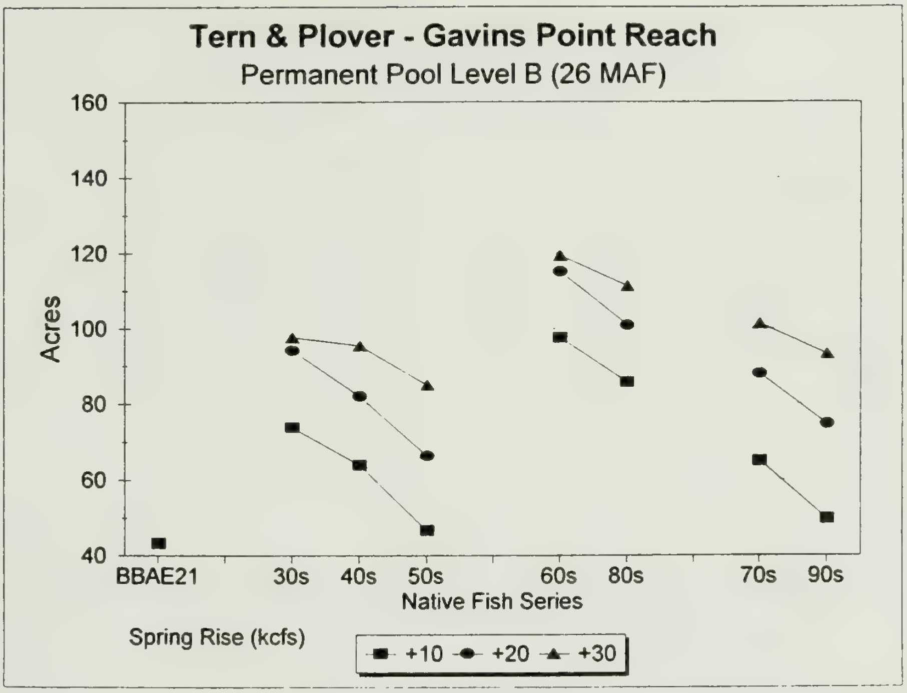

Figure 5-33. Mean tern and plover habitat under Native Fish alternatives for Gavins Point reach—26-MAF permanent pool level.

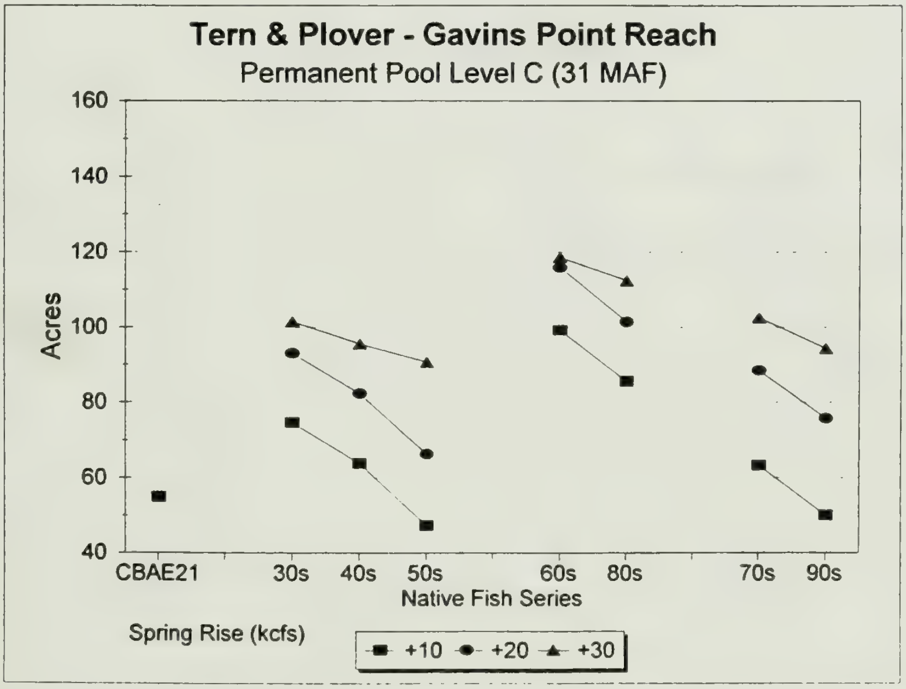

Figure 5-34. Mean tern and plover habitat under Native Fish alternatives for Gavins Point reach—31-MAF permanent pool level.

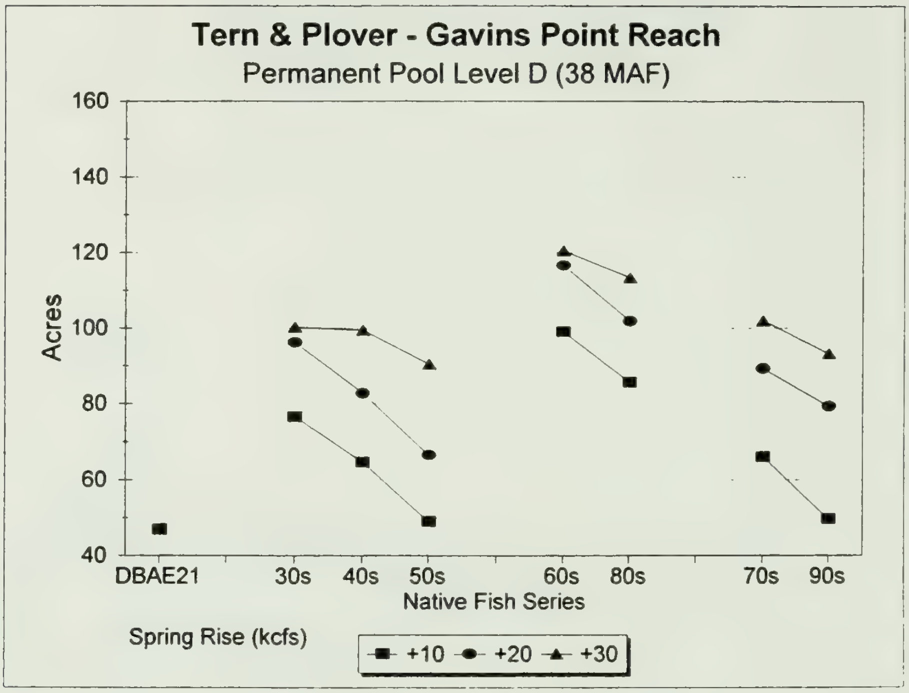

Figure 5-35. Mean tern and plover habitat under Native Fish alternatives for Gavins Point reach—38-MAF permanent pool level.

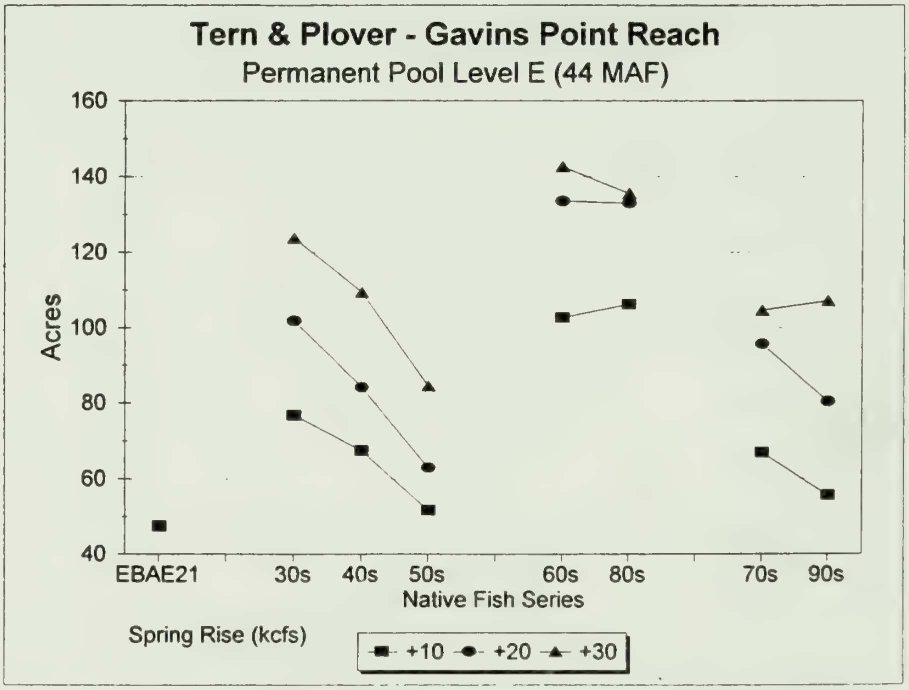

Figure 5-36. Mean tern and plover habitat under Native Fish alternatives for Gavins Point reach—44-MAF permanent pool level.

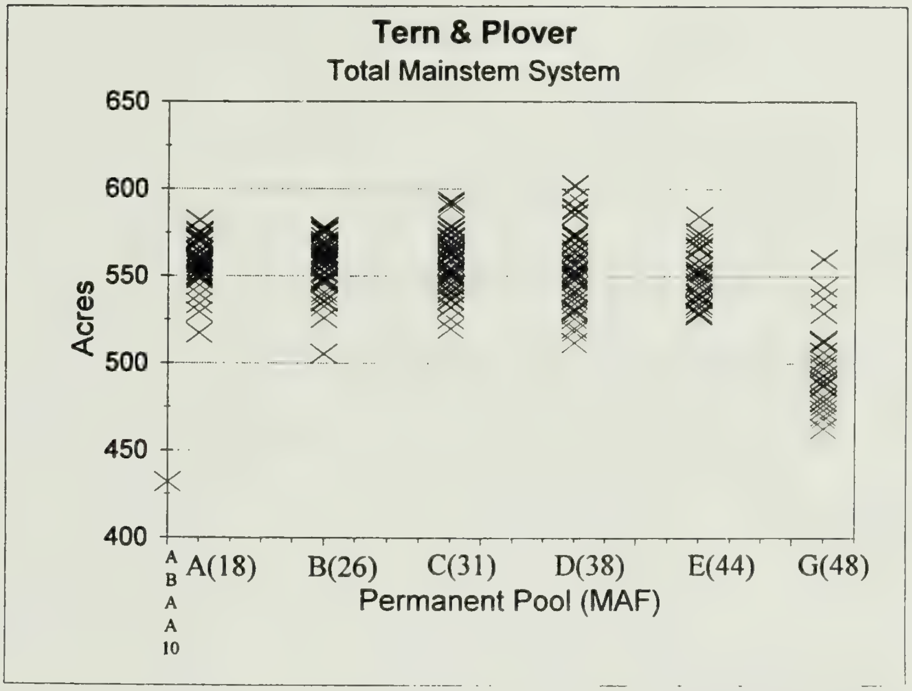

Figure 5-37. Mean tern and plover habitat for the Basic Set of alternatives grouped by permanent pool level.

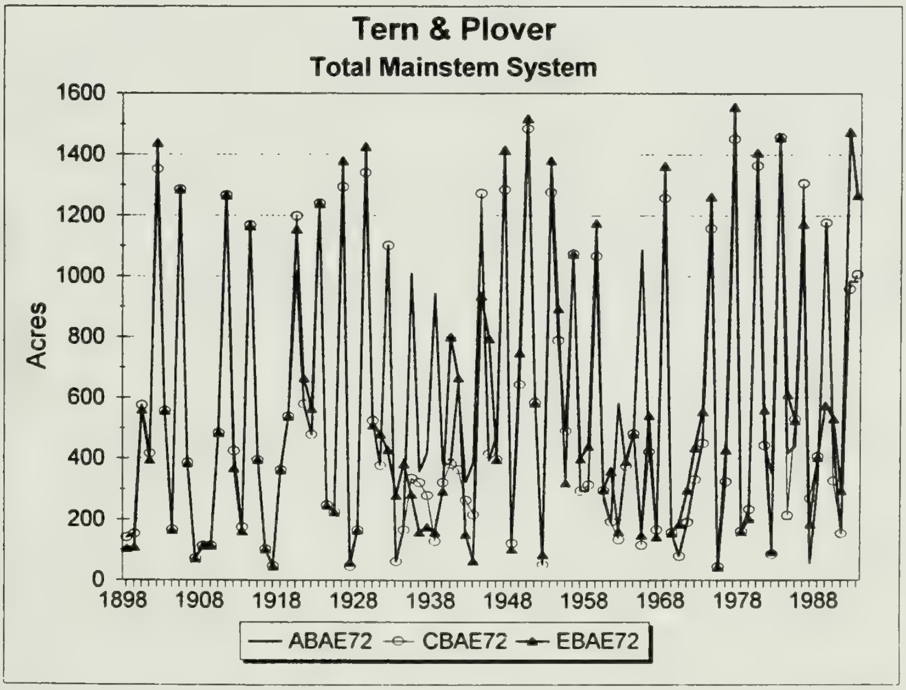

Figure 5-38. Annual tern and plover habitat for three alternatives with differing permanent pool levels.

6.0 YOUNG FISH PRODUCTION IN MAINSTEM LAKES

Several physical factors relate to fish production in the six mainstem lakes: lake elevation, inundated area, inflow, discharge, and flushing rate (Corps, 1994d). A statistical regression model was developed by the Corps that relates production and abundance indices of young fish in each lake to these factors (Corps, 1994d). Annual indices of production for key species in each lake were calculated for each year of the 96-year simulation period from 1898 to 1993 (see Table 6-1 at the end of the narrative section). The physical parameters that were related to production varied from lake to lake. Production indices for the upper three lakes correlated more closely to variables related to water surface elevation. In the lower three lakes, production indices relate mostly to inflow, discharge, and flushing rates.

6.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

6.1.1 Total System

The modified navigation and intrasystem regulation criteria would improve young fish production in the Mainstem System. The higher lake levels associated with the modified navigation criteria during droughts (see Section 3.1) lead to a slightly higher (1 percent) average index of production over the 96-year simulation period (Table 6-2). The difference in production occurs sporadically over the 96-year simulation period, but especially in drought periods such as in the late 1950s and 1980s (Figure 6-1). In 1937 the opposite pattern occurs because under the current criteria there would be no navigation service that year, thus leading to lower releases, higher lake levels, less flow through the lower three lakes, and higher overall production. Modified intrasystem regulation also increases young fish production in the total system (an average of 2 percent) (Table 6-2). This increase occurs sporadically over the 96-year simulation period (Figure 6-1). The combined effect of changes in both factors is about a 3-percent increase in young fish production over the 96-year simulation period.

Table 6-2. Average annual index of young fish production for the six mainstem lakes for four alternatives over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total Index	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis and Clark Lake
Current	Current	ABAA10	1.96	0.58	0.47	0.41	0.22	0.18	0.09
Modified	Current	ABAA20	1.98	0.62	0.47	0.41	0.21	0.18	0.08
Current	Modified	ABAA11	2.00	0.58	0.48	0.45	0.22	0.18	0.09
Modified	Modified	ABAA21	2.02	0.62	0.48	0.46	0.21	0.17	0.08

6.1.2 Fort Peck Lake

At Fort Peck Lake, production would be higher under the modified navigation criteria (Table 6-2; Figure 6-2), because lake levels would be higher especially during and following droughts like the late 1950s and late 1980s. There is little effect on young fish production from modified intrasystem regulation.

6.1.3 Lake Sakakawea

There is little effect on young fish production from the modified navigation criteria (Figure 6-3). Modified intrasystem regulation improves production measurably in 1 out of 3 years as expected (Figure 6-3).

6.1.4 Lake Oahe

There is little effect on young fish production in Lake Oahe from the modified navigation criteria (Table 6-2; Figure 6-4). Modified intrasystem regulation improves production substantially every third year (Figure 6-4), which leads to the average 10 to 15 percent improvement over the 96-year simulation period (Table 6-2).

6.1.5 Lake Sharpe

The modified navigation criteria have little effect on young fish production over the 96-year simulation period, except in 1937 (Figure 6-5) when there is support for navigation and thus more flow through the lake and less fish production. This factor balances out the production benefit of lower flows through the lake during drought periods under the modified navigation criteria. Modified intrasystem regulation would have little effect on production (Figure 6-5) as expected, because it would have little effect on flow or storage levels in Lake Sharpe.

6.1.6 Lake Francis Case

As Figure 6-6 shows, under the modified navigation criteria, young fish production in Lake Francis Case is slightly lower in drought periods (e.g., 1930s, late 1950s, and late 1980s). Production is lower because water is evacuated from the lake earlier in fall or in summer in periods of drought under the modified navigation criteria. Modified intrasystem regulation would have little effect on production.

6.1.7 Lewis and Clark Lake

The modified navigation and intrasystem regulation criteria would have little effect on young fish production in Lewis and Clark Lake (Figure 6-7). As for Lake Sharpe, production in the 96-year simulation period was substantially higher in 1937 under the current navigation criteria, because of lower flow through the lake without navigation releases from Lake Oahe.

6.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

6.2.1 Total System

Total young fish production in the six mainstem lakes would vary little with minimum nonnavigation service level in any season (Figure 6-8). At the higher minimum permanent pool levels (38 and 44 MAF), production is slightly higher in the simulation for alternatives with higher winter minimum service levels and lower spring/fall and summer minimum service levels. At lower permanent pool levels there is little effect from spring through fall because navigation service is rarely affected, even in drought periods. The slight effect in winter at lower permanent pool levels occurs because winter minimum service levels are active during droughts.

6.2.2 Fort Peck Lake

Young fish production in Fort Peck Lake would be slightly depressed with higher minimum nonnavigation service level (Figure 6-9). In drought periods, lake levels for the lower permanent pools would decline slightly with the higher minimum winter service levels, resulting in slightly lower production.

6.2.3 Lake Sakakawea

Production in Lake Sakakawea would be unaffected by changing minimum nonnavigation service levels even at higher permanent pool levels (Figure 6-10).

6.2.4 Lake Oahe

Young fish production in Lake Oahe would be reduced with higher winter minimum service levels (Figure 6-11), but the effect would be concentrated in drought periods. Higher winter minimum service levels increase releases and thus reduce storage levels in drought periods, which results in lower young fish production.

6.2.5 Lake Sharpe

Young fish production in Lake Sharpe increases with higher winter minimum nonnavigation service levels at the highest permanent pool level (44 MAF), but not at lower permanent pool levels (Figure 6-12). Higher winter flows result in lower summer flows and thus increased fish production at the highest permanent pool level. The higher winter flows during drought periods at the lower permanent pool levels do not affect fish production in the lake. Production is not affected by spring through fall minimum nonnavigation service levels, except at the highest permanent pool levels when these service levels would be active. Spring through fall minimum nonnavigation service levels are not activated at lower permanent pools, because there is navigation service in most months. At the highest permanent pool levels, navigation is supported less often and nonnavigation service applies. For higher summer minimum nonnavigation service levels at the higher permanent pool levels, production declines because production is negatively related to flows through the lake in summer.

6.2.6 Lake Francis Case

There is little difference in young fish production in Lake Francis Case due to minimum nonnavigation service levels (Figure 6-13).

6.2.7 Lewis and Clark Lake

The pattern observed at Lake Sharpe is also apparent at Lewis and Clark Lake (Figure 6-14).

6.3 EFFECT OF NATIVE FISH SERIES

Increasing spring releases from storage and reducing the length of the navigation season would have little effect on total young fish production in the six mainstem lakes (Figures 6-15 through 6-19). Eliminating flood control constraints on these high spring releases for flood control would reduce production slightly by reducing water levels in the upper three lakes and increasing spring flow through the lower three lakes. Reducing the navigation season to six months benefits production slightly (1 to 2 percent) if the reduction is during the summer (August and September). Reduced navigation support in summer would increase water levels in the upper three lakes and reduce summer flows through the lower three lakes, thus benefiting overall young fish production in the mainstem lakes.

6.4 PERMANENT POOL LEVEL

An increase in the permanent pool level increases total young fish production in the six mainstem lakes up to 10 percent (Figure 6-20). The greatest increase is at the highest permanent pool levels: 38 and 44 MAF. The increased production occurs in drought periods when differences in permanent pool levels affect water in storage and releases. At the higher permanent pool levels production is generally higher in the upper three lakes because higher lake levels are maintained. Production is higher in the lower three lakes because summer and fall flows through these lakes are lower during drought periods.

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Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
ABAA10	1.96	0.58	0.47	0.41	0.22	0.18	0.09
ABAA11	2.00	0.58	0.48	0.45	0.22	0.18	0.09
ABAA20	1.98	0.62	0.47	0.41	0.21	0.18	0.08
AAAA21	2.04	0.63	0.49	0.47	0.21	0.17	0.08
AAAB21	2.04	0.63	0.49	0.47	0.21	0.17	0.08
AAAC21	2.04	0.63	0.49	0.47	0.21	0.17	0.08
AAAD21	2.04	0.63	0.49	0.47	0.21	0.17	0.08
AAAE21	2.04	0.63	0.49	0.47	0.21	0.17	0.08
AABB21	2.04	0.63	0.49	0.46	0.21	0.17	0.08
AABC21	2.04	0.63	0.49	0.46	0.21	0.17	0.08
AABD21	2.04	0.63	0.49	0.46	0.21	0.17	0.08
AABE21	2.04	0.63	0.49	0.46	0.21	0.17	0.08
AACC21	2.03	0.62	0.49	0.46	0.21	0.17	0.08
AACD21	2.03	0.62	0.49	0.46	0.21	0.17	0.08
AACE21	2.03	0.62	0.49	0.46	0.21	0.17	0.08
AADD21	2.03	0.62	0.49	0.45	0.21	0.17	0.08
AADE21	2.03	0.62	0.48	0.45	0.21	0.17	0.08
AAEE21	2.01	0.61	0.48	0.44	0.22	0.18	0.09
ABAA21	2.02	0.62	0.48	0.46	0.21	0.17	0.08
ABAB21	2.02	0.62	0.48	0.46	0.21	0.17	0.08
ABAC21	2.02	0.62	0.48	0.46	0.21	0.17	0.08
ABAD21	2.02	0.62	0.48	0.46	0.21	0.17	0.08
ABAE21	2.02	0.62	0.48	0.46	0.21	0.17	0.08
ABBB21	2.02	0.62	0.48	0.45	0.21	0.17	0.09
ABBC21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
ABBD21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
ABBE21	2.01	0.62	0.48	0.45	0.21	0.17	0.08
ABCC21	2.02	0.62	0.48	0.45	0.21	0.17	0.09
ABCD21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
ABCE21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
ABDD21	2.03	0.62	0.48	0.45	0.21	0.18	0.09
ABDE21	2.02	0.62	0.48	0.45	0.21	0.18	0.08
ACAA21	2.01	0.62	0.48	0.45	0.20	0.17	0.09
ACAB21	2.00	0.62	0.48	0.44	0.20	0.17	0.09
ACAC21	2.02	0.62	0.48	0.45	0.21	0.18	0.09
ACAD21	2.01	0.62	0.48	0.45	0.21	0.17	0.09
ACAE21	2.00	0.62	0.48	0.45	0.20	0.17	0.08
ACBB21	2.02	0.62	0.48	0.44	0.21	0.17	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
ACBC21	2.01	0.62	0.48	0.44	0.21	0.17	0.09
ACBD21	2.01	0.62	0.48	0.45	0.21	0.17	0.09
ACBE21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
ACCC21	2.02	0.61	0.48	0.44	0.21	0.17	0.09
ACCD21	2.01	0.61	0.48	0.44	0.21	0.17	0.09
ACCE21	2.02	0.62	0.48	0.44	0.21	0.18	0.09
ACDD21	2.02	0.61	0.48	0.44	0.21	0.18	0.09
ACDE21	2.00	0.61	0.48	0.44	0.21	0.18	0.09
ADAA21	2.01	0.61	0.49	0.44	0.21	0.17	0.10
ADAB21	2.01	0.61	0.48	0.44	0.20	0.17	0.09
ADAC21	2.01	0.61	0.49	0.44	0.21	0.17	0.09
ADAD21	2.00	0.61	0.48	0.44	0.21	0.17	0.09
ADAE21	2.01	0.61	0.48	0.44	0.21	0.18	0.09
ADBB21	2.02	0.61	0.49	0.44	0.21	0.17	0.10
ADBC21	2.01	0.61	0.49	0.44	0.21	0.17	0.09
ADBD21	2.02	0.61	0.49	0.44	0.21	0.18	0.09
ADBE21	2.01	0.61	0.48	0.44	0.21	0.17	0.09
ADCC21	2.01	0.61	0.48	0.44	0.21	0.18	0.09
ADCD21	2.00	0.60	0.48	0.44	0.21	0.17	0.09
ADCE21	1.99	0.60	0.48	0.44	0.21	0.17	0.09
ADDD21	2.00	0.60	0.48	0.44	0.21	0.18	0.09
ADDE21	1.99	0.60	0.48	0.43	0.22	0.18	0.09
BAAA21	2.03	0.63	0.49	0.46	0.21	0.17	0.08
BAAB21	2.03	0.63	0.49	0.46	0.21	0.17	0.08
BAAC21	2.03	0.63	0.49	0.46	0.21	0.17	0.08
BAAD21	2.03	0.63	0.49	0.46	0.21	0.17	0.08
BAAE21	2.03	0.63	0.49	0.46	0.21	0.17	0.08
BABB21	2.03	0.63	0.48	0.46	0.21	0.17	0.08
BABC21	2.03	0.63	0.48	0.46	0.21	0.17	0.08
BABD21	2.03	0.63	0.48	0.46	0.21	0.17	0.08
BABE21	2.03	0.63	0.48	0.46	0.21	0.17	0.08
BACC21	2.04	0.63	0.48	0.45	0.22	0.17	0.09
BACD21	2.04	0.63	0.48	0.45	0.21	0.17	0.09
BACE21	2.04	0.63	0.48	0.46	0.21	0.17	0.08
BADD21	2.03	0.62	0.48	0.45	0.21	0.17	0.09
BADE21	2.04	0.62	0.48	0.45	0.22	0.18	0.08
BBAA21	2.03	0.62	0.48	0.45	0.21	0.17	0.09
BBAB21	2.04	0.63	0.48	0.45	0.21	0.17	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
BBAC21	2.03	0.63	0.48	0.45	0.21	0.17	0.09
BBAD21	2.03	0.63	0.48	0.45	0.21	0.17	0.09
BBAE21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
BBBB21	2.03	0.62	0.48	0.45	0.21	0.17	0.09
BBBC21	2.03	0.62	0.48	0.45	0.21	0.17	0.09
BBBD21	2.02	0.62	0.48	0.45	0.21	0.17	0.09
BBBE21	2.04	0.62	0.48	0.45	0.22	0.18	0.08
BBCC21	2.04	0.62	0.48	0.44	0.22	0.18	0.09
BBCD21	2.02	0.62	0.48	0.44	0.22	0.17	0.09
BBCE21	2.03	0.62	0.48	0.45	0.22	0.18	0.08
BBDD21	2.03	0.62	0.48	0.44	0.22	0.18	0.09
BBDE21	2.02	0.62	0.48	0.44	0.22	0.18	0.08
BCAA21	2.03	0.62	0.48	0.44	0.21	0.17	0.10
BCAB21	2.02	0.62	0.48	0.44	0.21	0.17	0.09
BCAC21	2.01	0.62	0.48	0.44	0.21	0.17	0.09
BCAD21	2.02	0.62	0.48	0.44	0.21	0.17	0.09
BCAE21	2.02	0.62	0.48	0.45	0.21	0.17	0.08
BCBB21	2.02	0.62	0.48	0.44	0.21	0.17	0.10
BCBC21	2.02	0.62	0.48	0.44	0.21	0.17	0.09
BCBD21	2.01	0.62	0.48	0.44	0.21	0.17	0.09
BCBE21	2.01	0.62	0.48	0.44	0.21	0.18	0.08
BCCC21	2.04	0.62	0.48	0.44	0.22	0.18	0.10
BCCD21	2.03	0.62	0.48	0.44	0.21	0.18	0.09
BCCE21	2.02	0.62	0.48	0.44	0.22	0.18	0.09
BCDD21	2.02	0.61	0.48	0.44	0.21	0.18	0.09
BCDE21	2.01	0.61	0.47	0.43	0.22	0.19	0.09
BDAA21	1.99	0.62	0.48	0.42	0.21	0.17	0.10
BDAB21	2.02	0.62	0.49	0.44	0.21	0.18	0.10
BDAC21	2.01	0.61	0.48	0.44	0.21	0.17	0.10
BDAD21	2.03	0.62	0.49	0.44	0.21	0.18	0.09
BDAE21	2.01	0.61	0.48	0.44	0.21	0.18	0.09
BDBB21	2.03	0.61	0.49	0.43	0.22	0.17	0.10
BDBC21	2.03	0.62	0.48	0.44	0.22	0.18	0.10
BDBD21	2.02	0.62	0.48	0.44	0.22	0.18	0.09
BDBE21	2.01	0.61	0.48	0.43	0.22	0.18	0.09
BDCC21	2.02	0.61	0.48	0.43	0.22	0.18	0.10
BDCD21	2.01	0.61	0.48	0.43	0.21	0.18	0.09
BDCE21	2.01	0.61	0.48	0.43	0.22	0.18	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
BDDD21	2.00	0.60	0.48	0.42	0.21	0.18	0.10
CAAA21	2.06	0.63	0.48	0.46	0.21	0.17	0.09
CAAB21	2.05	0.63	0.48	0.46	0.21	0.17	0.09
CAAC21	2.05	0.63	0.48	0.46	0.21	0.17	0.09
CAAD21	2.05	0.63	0.48	0.46	0.21	0.17	0.08
CAAE21	2.05	0.63	0.48	0.46	0.21	0.17	0.08
CABB21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CABC21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CABD21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CABE21	2.05	0.63	0.48	0.46	0.22	0.18	0.08
CACC21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CACD21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CACE21	2.05	0.63	0.48	0.46	0.22	0.18	0.08
CADD21	2.05	0.63	0.48	0.45	0.22	0.18	0.09
CADE21	2.04	0.63	0.48	0.45	0.22	0.18	0.08
CBAA21	2.04	0.63	0.48	0.45	0.22	0.17	0.09
CBAB21	2.04	0.63	0.48	0.45	0.22	0.17	0.09
CBAC21	2.04	0.63	0.48	0.45	0.22	0.17	0.09
CBAD21	2.04	0.63	0.48	0.45	0.22	0.18	0.09
CBAE21	2.03	0.63	0.48	0.45	0.21	0.18	0.08
CBBB21	2.05	0.63	0.48	0.45	0.22	0.17	0.10
CBBC21	2.04	0.63	0.48	0.45	0.22	0.18	0.09
CBBD21	2.04	0.63	0.48	0.45	0.22	0.18	0.09
CBBE21	2.05	0.63	0.48	0.45	0.22	0.18	0.08
CBCC21	2.05	0.63	0.48	0.44	0.22	0.18	0.09
CBCD21	2.03	0.62	0.48	0.44	0.22	0.18	0.09
CBCE21	2.03	0.63	0.48	0.44	0.22	0.18	0.09
CBDD21	2.05	0.63	0.48	0.43	0.23	0.19	0.09
CBDE21	2.04	0.62	0.48	0.44	0.23	0.19	0.09
CCAA21	2.04	0.63	0.48	0.44	0.22	0.17	0.10
CCAB21	2.03	0.62	0.48	0.44	0.21	0.17	0.10
CCAC21	2.02	0.62	0.48	0.44	0.21	0.17	0.09
CCAD21	2.02	0.62	0.48	0.44	0.21	0.17	0.09
CCAE21	2.03	0.63	0.48	0.44	0.22	0.18	0.09
CCBB21	2.04	0.62	0.48	0.44	0.22	0.18	0.10
CCBC21	2.04	0.62	0.48	0.44	0.22	0.18	0.09
CCBD21	2.03	0.62	0.48	0.44	0.22	0.18	0.09
CCBE21	2.03	0.62	0.48	0.44	0.22	0.18	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
CCCC21	2.05	0.62	0.48	0.44	0.22	0.18	0.10
CCCD21	2.03	0.62	0.48	0.43	0.22	0.18	0.10
CCCE21	2.03	0.62	0.48	0.43	0.22	0.19	0.09
CCDD21	2.03	0.62	0.48	0.42	0.22	0.19	0.10
CDAA21	2.04	0.62	0.49	0.44	0.21	0.17	0.11
CDAB21	2.03	0.62	0.49	0.44	0.21	0.17	0.10
CDAC21	2.02	0.62	0.48	0.44	0.21	0.17	0.10
CDAD21	2.03	0.62	0.48	0.44	0.22	0.18	0.09
CDAE21	2.02	0.62	0.48	0.43	0.22	0.18	0.09
CDBB21	2.04	0.62	0.48	0.43	0.22	0.18	0.10
CDBC21	2.04	0.62	0.48	0.43	0.22	0.18	0.10
CDBD21	2.03	0.62	0.48	0.43	0.22	0.18	0.10
CDBE21	2.02	0.62	0.48	0.43	0.22	0.18	0.09
CDCC21	2.01	0.62	0.48	0.42	0.22	0.18	0.10
CDCD21	2.05	0.62	0.48	0.43	0.23	0.19	0.10
CDDD21	2.04	0.61	0.48	0.42	0.23	0.19	0.10
DAAA21	2.06	0.64	0.49	0.45	0.22	0.17	0.09
DAAB21	2.06	0.64	0.49	0.45	0.22	0.17	0.09
DAAC21	2.06	0.64	0.49	0.45	0.22	0.17	0.09
DAAD21	2.05	0.64	0.49	0.45	0.22	0.17	0.09
DAAE21	2.05	0.64	0.49	0.45	0.22	0.18	0.08
DABB21	2.07	0.64	0.49	0.45	0.23	0.17	0.09
DABC21	2.06	0.64	0.49	0.45	0.22	0.17	0.09
DABD21	2.01	0.64	0.47	0.42	0.22	0.17	0.09
DABE21	2.05	0.64	0.48	0.44	0.23	0.18	0.08
DACC21	2.06	0.64	0.48	0.44	0.23	0.18	0.09
DACD21	2.07	0.64	0.49	0.44	0.23	0.18	0.09
DACE21	2.06	0.64	0.48	0.44	0.23	0.18	0.09
DADD21	2.06	0.64	0.49	0.43	0.23	0.18	0.09
DBAA21	2.09	0.64	0.49	0.44	0.23	0.18	0.11
DBAB21	2.06	0.64	0.49	0.43	0.23	0.17	0.10
DBAC21	2.05	0.64	0.49	0.43	0.23	0.17	0.09
DBAD21	2.05	0.64	0.48	0.43	0.23	0.18	0.09
DBAE21	2.04	0.63	0.48	0.44	0.22	0.18	0.08
DBBB21	2.06	0.64	0.49	0.43	0.23	0.17	0.10
DBBC21	2.06	0.64	0.48	0.43	0.23	0.18	0.10
DBBD21	2.05	0.64	0.48	0.43	0.23	0.18	0.09
DBBE21	2.07	0.64	0.48	0.44	0.23	0.18	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
DBCC21	2.05	0.63	0.48	0.43	0.23	0.18	0.10
DBCD21	2.07	0.64	0.49	0.43	0.24	0.18	0.10
DBDD21	2.07	0.64	0.48	0.43	0.24	0.19	0.10
DCAA21	2.06	0.64	0.48	0.43	0.22	0.17	0.11
DCAB21	2.04	0.63	0.48	0.43	0.22	0.17	0.10
DCAC21	2.04	0.64	0.48	0.42	0.22	0.17	0.10
DCAD21	2.03	0.63	0.48	0.43	0.22	0.18	0.09
DCAE21	2.05	0.64	0.48	0.43	0.23	0.18	0.09
DCBB21	2.06	0.63	0.48	0.43	0.23	0.18	0.11
DCBC21	2.06	0.63	0.48	0.43	0.23	0.18	0.10
DCBD21	2.04	0.63	0.48	0.43	0.23	0.18	0.09
DCBE21	2.07	0.64	0.48	0.41	0.25	0.20	0.09
DCCC21	2.06	0.64	0.49	0.42	0.23	0.18	0.10
DCCD21	2.08	0.64	0.48	0.42	0.24	0.19	0.10
DCDD21	2.09	0.65	0.48	0.41	0.25	0.21	0.10
DDAA21	2.07	0.63	0.49	0.43	0.23	0.17	0.12
DDAB21	2.09	0.64	0.49	0.43	0.23	0.19	0.11
DDAC21	2.05	0.64	0.49	0.42	0.23	0.18	0.10
DDAD21	2.05	0.63	0.49	0.42	0.22	0.18	0.10
DDAE21	2.06	0.64	0.48	0.41	0.25	0.19	0.09
DDBB21	2.06	0.63	0.49	0.42	0.23	0.18	0.11
DDBC21	2.05	0.63	0.49	0.42	0.23	0.18	0.10
DDBD21	2.06	0.63	0.49	0.42	0.23	0.18	0.10
DDCC21	2.07	0.63	0.49	0.42	0.23	0.19	0.11
DDCD21	2.09	0.65	0.48	0.40	0.25	0.21	0.10
EAAA21	2.17	0.65	0.49	0.45	0.27	0.19	0.11
EAAB21	2.15	0.65	0.49	0.45	0.26	0.19	0.10
EAAC21	2.12	0.65	0.49	0.45	0.25	0.19	0.10
EAAD21	2.11	0.66	0.49	0.45	0.25	0.18	0.09
EAAE21	2.08	0.65	0.48	0.45	0.23	0.18	0.08
EABB21	2.15	0.66	0.49	0.45	0.26	0.19	0.10
EABC21	2.12	0.66	0.49	0.45	0.25	0.18	0.10
EABD21	2.11	0.65	0.49	0.44	0.24	0.19	0.09
EABE21	2.07	0.65	0.48	0.44	0.23	0.18	0.09
EACC21	2.10	0.65	0.49	0.44	0.24	0.19	0.10
EACD21	2.08	0.65	0.48	0.44	0.23	0.19	0.09
EADD21	2.09	0.65	0.49	0.44	0.24	0.19	0.10
EBAA21	2.15	0.65	0.49	0.44	0.26	0.19	0.12

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
EBAB21	2.14	0.66	0.49	0.45	0.25	0.19	0.11
EBAC21	2.13	0.66	0.49	0.44	0.26	0.19	0.10
EBAD21	2.09	0.65	0.49	0.44	0.24	0.18	0.09
EBAE21	2.07	0.65	0.48	0.44	0.23	0.18	0.09
EBBB21	2.14	0.66	0.49	0.43	0.27	0.19	0.11
EBBC21	2.10	0.66	0.48	0.43	0.25	0.19	0.10
EBBD21	2.09	0.65	0.48	0.44	0.24	0.19	0.09
EBCC21	2.13	0.66	0.49	0.43	0.25	0.20	0.10
EBCD21	2.09	0.65	0.48	0.43	0.24	0.19	0.10
ECAA21	2.12	0.66	0.49	0.43	0.25	0.18	0.12
ECAB21	2.11	0.66	0.49	0.43	0.25	0.19	0.11
ECAC21	2.11	0.66	0.49	0.43	0.25	0.18	0.11
ECAD21	2.11	0.66	0.49	0.43	0.25	0.19	0.10
ECBB21	2.10	0.65	0.48	0.42	0.24	0.18	0.11
ECBC21	2.12	0.66	0.49	0.43	0.25	0.20	0.11
ECBD21	2.10	0.65	0.48	0.43	0.24	0.19	0.10
ECCC21	2.14	0.66	0.48	0.41	0.27	0.20	0.11
ECCD21	2.13	0.66	0.48	0.41	0.26	0.21	0.10
EDAA21	2.16	0.67	0.48	0.41	0.27	0.19	0.14
EDAB21	2.16	0.67	0.49	0.41	0.27	0.20	0.13
EDAC21	2.14	0.66	0.48	0.41	0.27	0.21	0.11
EDBB21	2.17	0.66	0.48	0.41	0.27	0.21	0.13
EDBC21	2.15	0.66	0.48	0.41	0.27	0.21	0.11
EDBD21	2.14	0.67	0.48	0.41	0.27	0.21	0.11
EDCC21	2.14	0.67	0.48	0.41	0.27	0.21	0.12
GAAA21	2.12	0.69	0.47	0.43	0.24	0.18	0.11
GAAB21	2.17	0.68	0.48	0.44	0.27	0.18	0.11
GAAC21	2.14	0.68	0.48	0.44	0.26	0.18	0.10
GAAD21	2.14	0.68	0.48	0.45	0.25	0.18	0.09
GAAE21	2.11	0.68	0.47	0.45	0.24	0.18	0.08
GABB21	2.20	0.69	0.47	0.42	0.30	0.19	0.12
GABC21	2.18	0.69	0.47	0.42	0.29	0.19	0.11
GABD21	2.14	0.69	0.47	0.42	0.27	0.19	0.10
GACC21	2.15	0.69	0.47	0.42	0.28	0.19	0.11
GACD21	2.15	0.68	0.47	0.42	0.28	0.20	0.10
GBAA21	2.20	0.69	0.47	0.42	0.30	0.19	0.13
GBAB21	2.17	0.69	0.47	0.42	0.28	0.19	0.12
GBAC21	2.16	0.69	0.47	0.42	0.28	0.19	0.11

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
GBAD21	2.12	0.69	0.47	0.42	0.27	0.19	0.10
GBBB21	2.22	0.69	0.47	0.42	0.32	0.20	0.12
GBBC21	2.14	0.68	0.47	0.41	0.28	0.19	0.11
GBBD21	2.13	0.68	0.47	0.41	0.27	0.19	0.10
GBCC21	2.17	0.68	0.47	0.41	0.30	0.20	0.11
GCAA21	2.23	0.69	0.48	0.41	0.32	0.19	0.14
GCAB21	2.20	0.69	0.47	0.41	0.32	0.19	0.12
GCAC21	2.18	0.69	0.47	0.41	0.31	0.19	0.11
GCAD21	2.15	0.69	0.47	0.41	0.29	0.19	0.10
GCBB21	2.20	0.69	0.47	0.41	0.32	0.19	0.12
GDAA21	2.21	0.69	0.47	0.40	0.32	0.19	0.14
ABAE31	2.03	0.61	0.50	0.48	0.18	0.18	0.08
BBAE31	2.03	0.61	0.50	0.47	0.18	0.18	0.08
CBAE31	2.03	0.61	0.50	0.47	0.19	0.18	0.08
DBAE31	2.04	0.62	0.49	0.46	0.20	0.19	0.09
EBAE31	2.06	0.64	0.50	0.46	0.20	0.18	0.09
ABAE32	2.01	0.59	0.50	0.49	0.16	0.19	0.08
BBAE32	2.03	0.59	0.50	0.49	0.16	0.19	0.08
CBAE32	2.02	0.59	0.50	0.49	0.17	0.19	0.08
DBAE32	2.02	0.60	0.50	0.47	0.18	0.20	0.08
EBAE32	2.07	0.62	0.51	0.47	0.18	0.20	0.09
ABAE33	2.01	0.57	0.51	0.51	0.15	0.19	0.08
BBAE33	2.02	0.58	0.51	0.50	0.16	0.19	0.08
CBAE33	2.03	0.58	0.51	0.50	0.16	0.20	0.08
DBAE33	2.04	0.59	0.51	0.49	0.17	0.20	0.09
EBAE33	2.07	0.62	0.49	0.45	0.21	0.21	0.09
ABAE41	2.00	0.60	0.50	0.48	0.16	0.18	0.08
BBAE41	2.01	0.60	0.50	0.48	0.16	0.18	0.08
CBAE41	2.00	0.60	0.50	0.48	0.16	0.18	0.08
DBAE41	2.01	0.61	0.49	0.46	0.18	0.18	0.09
EBAE41	2.04	0.63	0.50	0.46	0.18	0.18	0.09
ABAE42	1.98	0.58	0.50	0.49	0.15	0.18	0.08
BBAE42	2.00	0.58	0.50	0.49	0.15	0.19	0.08
CBAE42	1.99	0.58	0.50	0.49	0.15	0.19	0.08
DBAE42	2.02	0.60	0.50	0.48	0.17	0.19	0.09
EBAE42	2.03	0.61	0.50	0.47	0.16	0.19	0.09
ABAE43	1.99	0.56	0.51	0.51	0.14	0.19	0.08
BBAE43	2.00	0.57	0.51	0.51	0.15	0.19	0.08

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
CBAE43	2.00	0.57	0.51	0.50	0.15	0.19	0.08
DBAE43	2.02	0.58	0.51	0.49	0.16	0.20	0.08
EBAE43	2.03	0.61	0.49	0.44	0.20	0.20	0.09
ABAE51	1.96	0.59	0.49	0.48	0.13	0.18	0.08
BBAE51	1.97	0.60	0.50	0.48	0.14	0.18	0.08
CBAE51	1.97	0.60	0.49	0.47	0.14	0.18	0.08
DBAE51	1.97	0.60	0.49	0.45	0.15	0.19	0.09
EBAE51	2.01	0.62	0.50	0.46	0.16	0.19	0.09
ABAE52	1.96	0.58	0.50	0.49	0.13	0.19	0.08
BBAE52	1.97	0.58	0.50	0.49	0.13	0.19	0.08
CBAE52	1.98	0.58	0.50	0.48	0.14	0.19	0.08
DBAE52	1.98	0.59	0.49	0.46	0.15	0.20	0.08
EBAE52	2.00	0.61	0.50	0.47	0.15	0.19	0.09
ABAE53	1.97	0.56	0.50	0.51	0.13	0.19	0.08
BBAE53	1.98	0.56	0.50	0.51	0.13	0.19	0.08
CBAE53	1.99	0.56	0.50	0.50	0.14	0.20	0.08
DBAE53	1.99	0.57	0.50	0.49	0.14	0.20	0.08
EBAE53	2.02	0.59	0.51	0.48	0.15	0.20	0.09
ABAE61	2.06	0.61	0.52	0.46	0.16	0.21	0.10
BBAE61	2.05	0.61	0.52	0.45	0.16	0.21	0.10
CBAE61	2.06	0.61	0.52	0.45	0.16	0.21	0.10
DBAE61	2.07	0.62	0.52	0.44	0.17	0.21	0.10
EBAE61	2.09	0.64	0.52	0.44	0.18	0.22	0.10
ABAE62	2.06	0.59	0.52	0.48	0.15	0.22	0.10
BBAE62	2.06	0.59	0.52	0.47	0.15	0.22	0.10
CBAE62	2.05	0.59	0.52	0.46	0.16	0.22	0.10
DBAE62	2.07	0.60	0.53	0.46	0.16	0.23	0.10
EBAE62	2.08	0.63	0.51	0.42	0.18	0.23	0.10
ABAE63	2.03	0.57	0.52	0.48	0.14	0.22	0.10
BBAE63	2.05	0.57	0.53	0.48	0.15	0.23	0.10
CBAE63	2.03	0.57	0.52	0.47	0.15	0.23	0.10
DBAE63	2.06	0.58	0.52	0.47	0.16	0.23	0.10
EBAE63	2.11	0.62	0.51	0.46	0.17	0.24	0.10
ABAE71	2.02	0.61	0.50	0.49	0.15	0.18	0.08
BBAE71	2.02	0.62	0.50	0.49	0.15	0.18	0.08
CBAE71	2.02	0.62	0.50	0.48	0.16	0.18	0.08
DBAE71	2.03	0.63	0.49	0.47	0.17	0.19	0.08
EBAE71	2.06	0.64	0.50	0.46	0.18	0.18	0.09

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
ABAE72	2.02	0.59	0.50	0.51	0.14	0.19	0.08
BBAE72	2.02	0.60	0.50	0.51	0.14	0.19	0.08
CBAE72	2.02	0.60	0.50	0.50	0.14	0.20	0.08
DBAE72	2.04	0.60	0.50	0.49	0.16	0.20	0.08
EBAE72	2.07	0.62	0.51	0.49	0.17	0.20	0.09
ABAE73	2.02	0.57	0.51	0.53	0.13	0.20	0.08
BBAE73	2.02	0.58	0.51	0.52	0.14	0.20	0.08
CBAE73	2.02	0.57	0.51	0.52	0.14	0.20	0.08
DBAE73	2.05	0.59	0.51	0.51	0.16	0.21	0.09
EBAE73	2.04	0.60	0.51	0.49	0.16	0.20	0.09
ABAE81	2.03	0.61	0.51	0.46	0.14	0.21	0.10
BBAE81	2.02	0.61	0.51	0.45	0.14	0.21	0.10
CBAE81	2.03	0.61	0.51	0.45	0.15	0.21	0.10
DBAE81	2.04	0.62	0.52	0.44	0.15	0.22	0.10
EBAE81	2.08	0.67	0.50	0.41	0.18	0.22	0.10
ABAE82	2.03	0.58	0.52	0.47	0.14	0.22	0.10
BBAE82	2.03	0.58	0.52	0.47	0.14	0.22	0.10
CBAE82	2.02	0.58	0.51	0.46	0.14	0.22	0.10
DBAE82	2.03	0.59	0.52	0.45	0.15	0.22	0.10
EBAE82	2.14	0.66	0.50	0.42	0.20	0.26	0.11
ABAE83	2.01	0.56	0.52	0.48	0.14	0.23	0.10
BBAE83	2.04	0.57	0.52	0.49	0.14	0.23	0.10
CBAE83	2.01	0.56	0.52	0.47	0.14	0.23	0.10
DBAE83	2.01	0.57	0.50	0.45	0.15	0.24	0.10
EBAE83	2.15	0.65	0.50	0.43	0.21	0.26	0.11
ABAE91	1.98	0.61	0.49	0.49	0.12	0.18	0.08
BBAE91	1.98	0.61	0.49	0.48	0.13	0.18	0.08
CBAE91	1.98	0.61	0.49	0.48	0.13	0.19	0.08
DBAE91	2.00	0.62	0.49	0.47	0.15	0.19	0.08
EBAE91	2.03	0.64	0.50	0.47	0.15	0.19	0.09
ABAE92	1.99	0.59	0.50	0.51	0.12	0.19	0.08
BBAE92	1.99	0.59	0.50	0.50	0.12	0.19	0.08
CBAE92	2.00	0.59	0.50	0.50	0.13	0.20	0.08
DBAE92	2.01	0.60	0.50	0.49	0.14	0.20	0.08
EBAE92	2.04	0.62	0.51	0.49	0.15	0.20	0.09
ABAE93	1.99	0.57	0.50	0.52	0.12	0.20	0.08
BBAE93	2.00	0.57	0.50	0.52	0.13	0.20	0.08
CBAE93	2.01	0.57	0.50	0.52	0.13	0.21	0.08

Table 6-1. Average annual production index of young fish in the Mainstem System over the 96-year simulation period.

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe	Lake Sharpe	Lake Francis Case	Lewis & Clark Lake
DBAE93	2.02	0.58	0.50	0.51	0.14	0.21	0.08
EBAE93	2.03	0.62	0.48	0.45	0.18	0.21	0.09
EVQ2XX	1.89	0.57	0.36	0.39	0.08	0.36	0.13

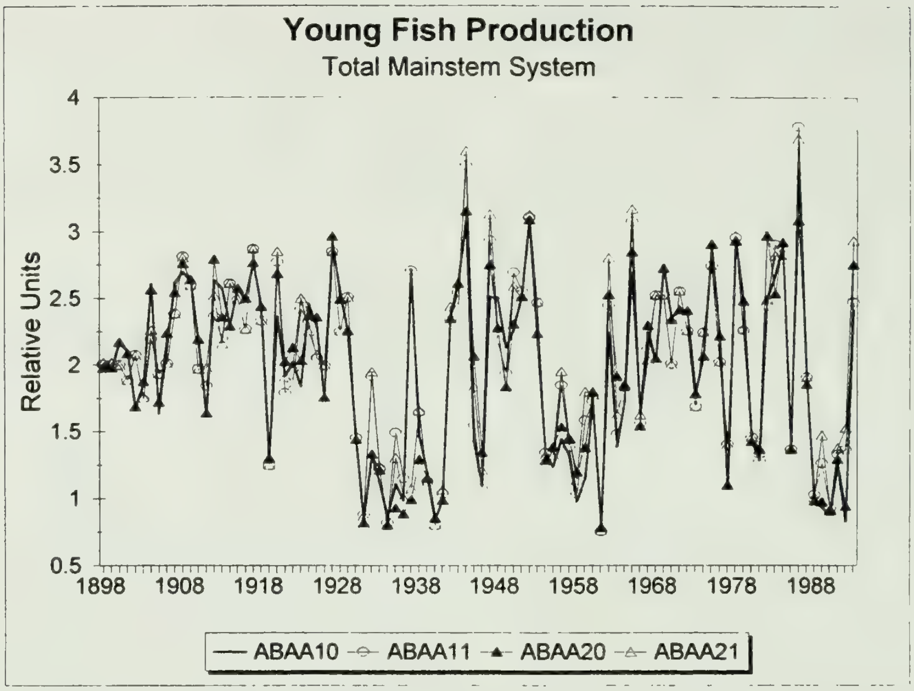

Figure 6-1. Annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

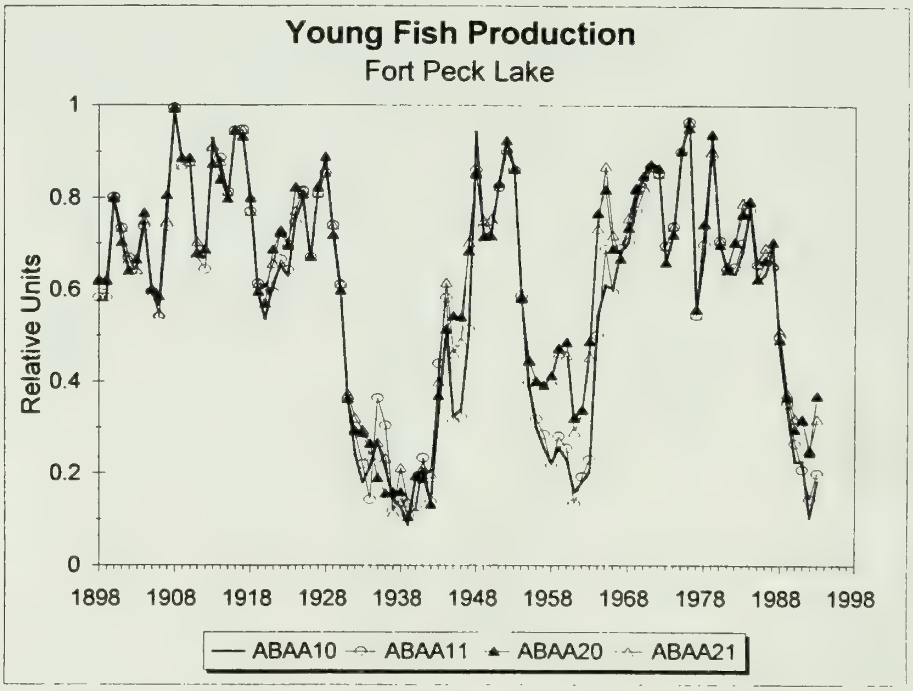

Figure 6-2. Annual index of total young fish production in Fort Peck Lake over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

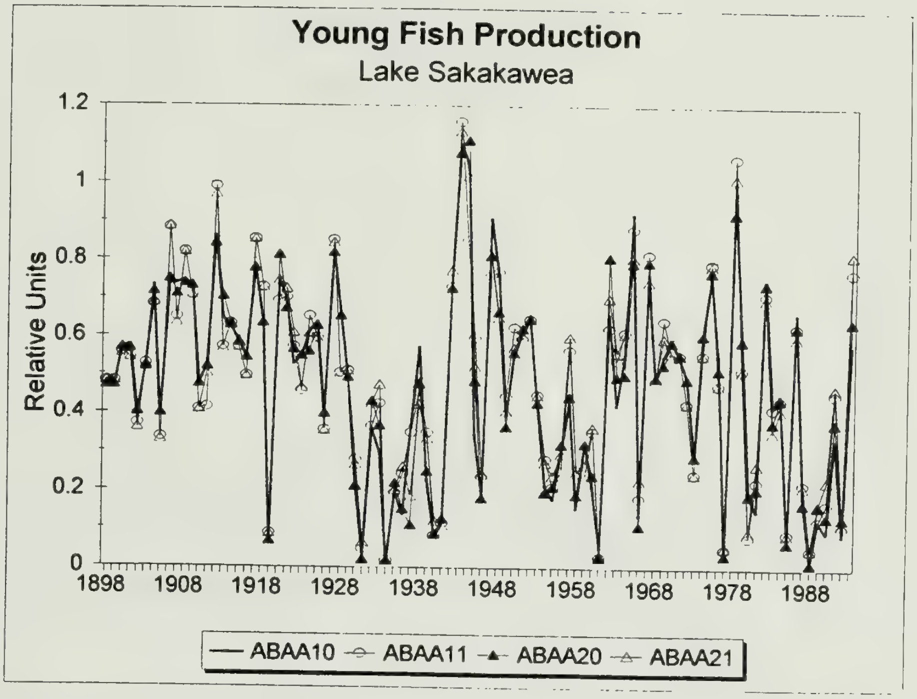

Figure 6-3. Annual index of total young fish production in Lake Sakakawea over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

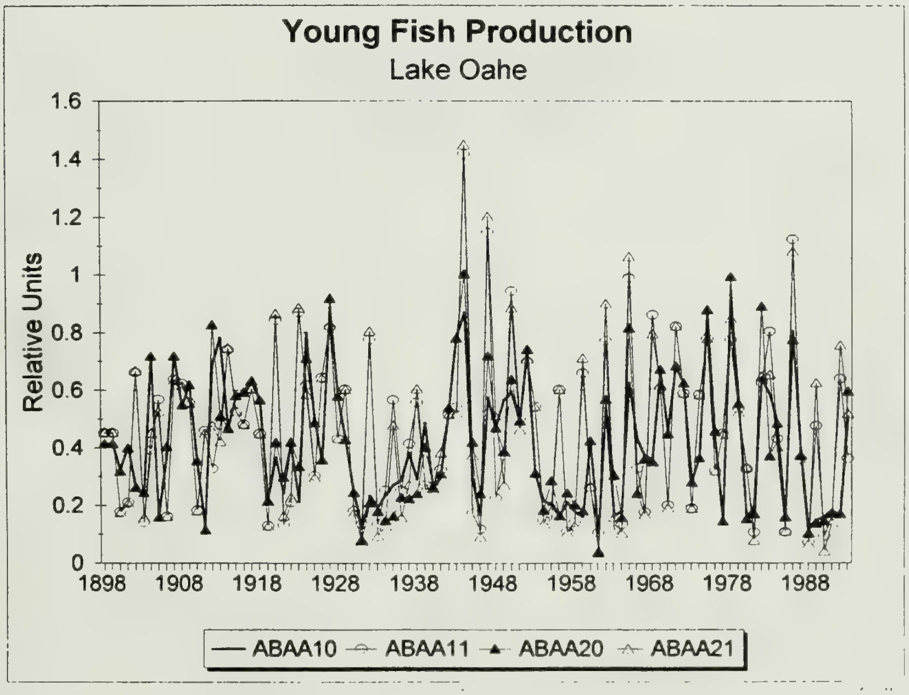

Figure 6-4. Annual index of total young fish production in Lake Oahe over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

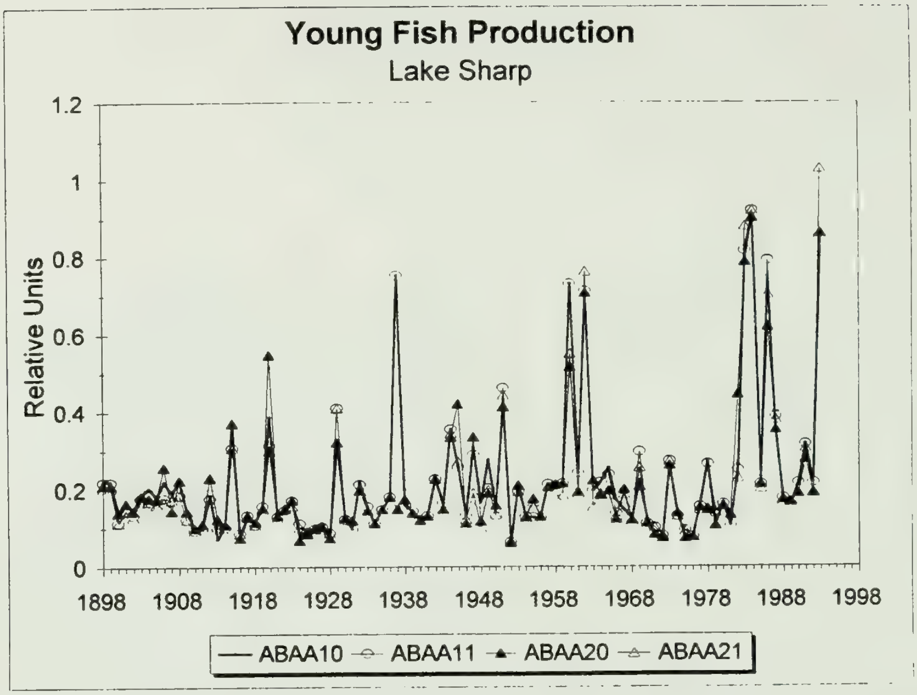

Figure 6-5. Annual index of total young fish production in Lake Sharpe over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

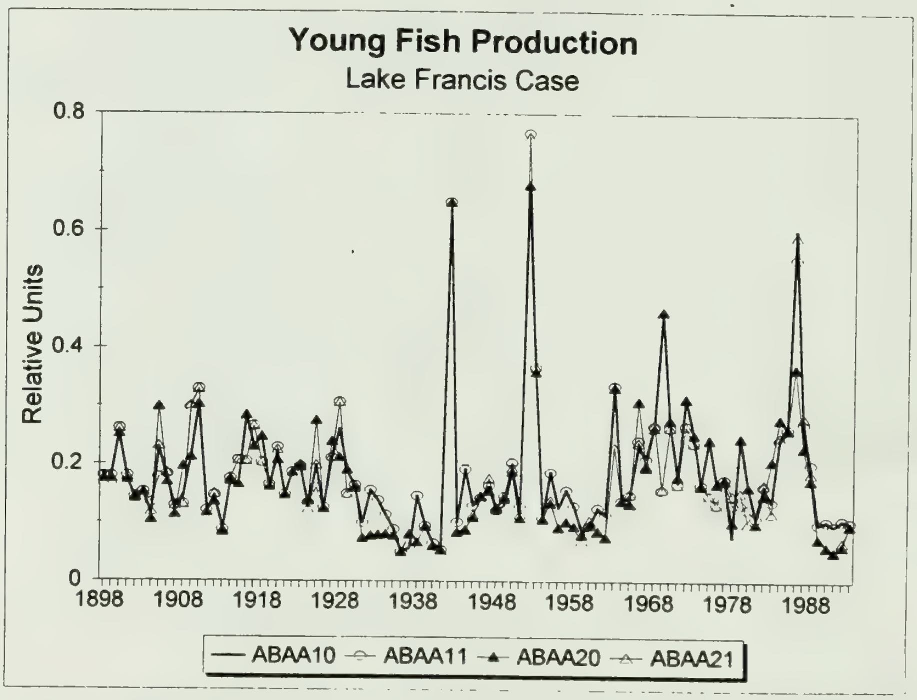

Figure 6-6. Annual index of total young fish production in Lake Francis Case over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

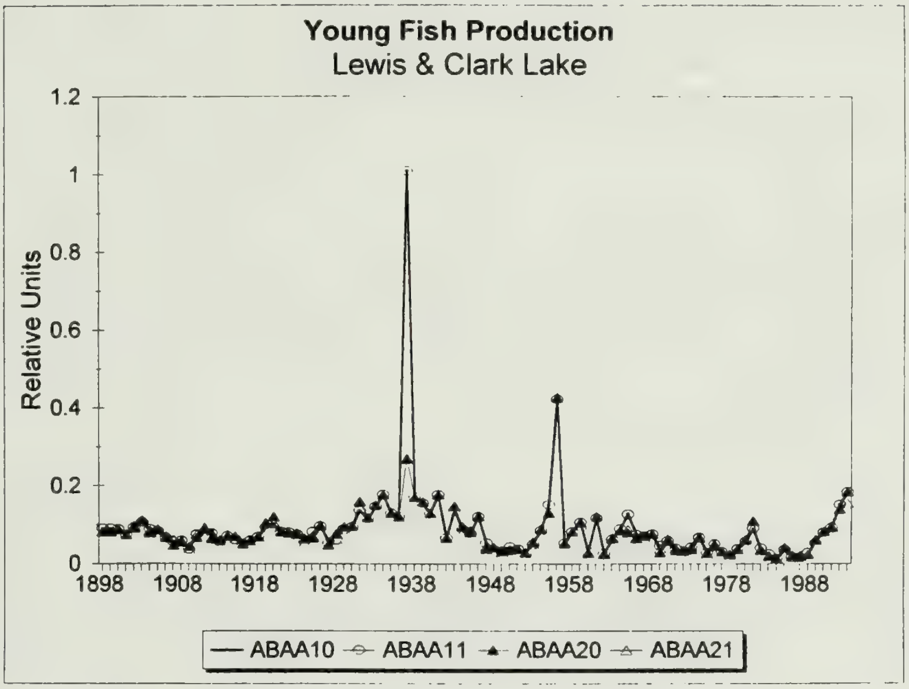

Figure 6-7. Annual index of total young fish production in Lewis and Clark Lake over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

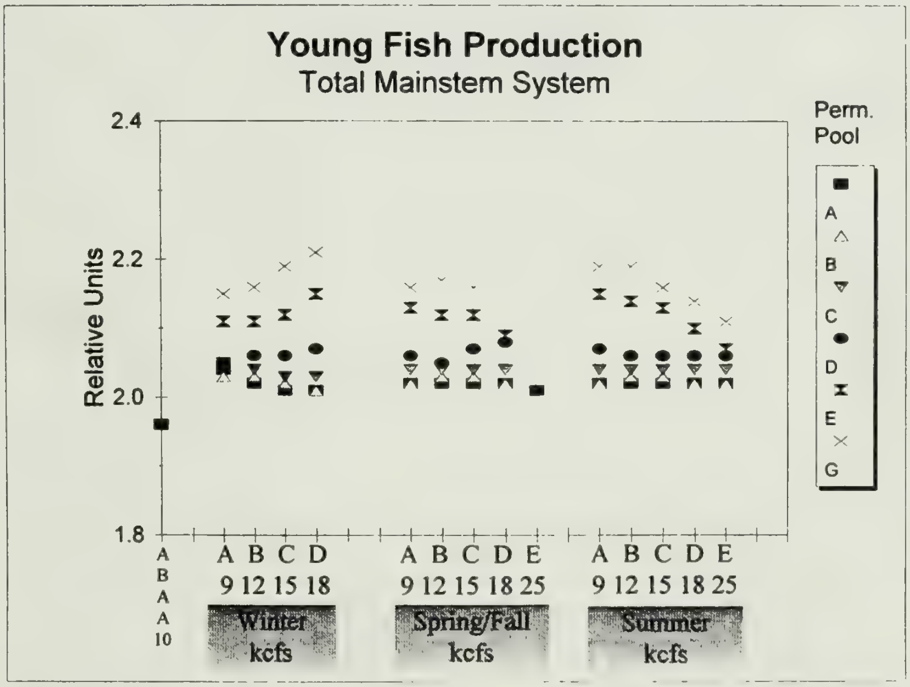

Figure 6-8. Annual index of total young fish production in the six mainstem lakes over the 96-year simulation period by nonnavigation service level.

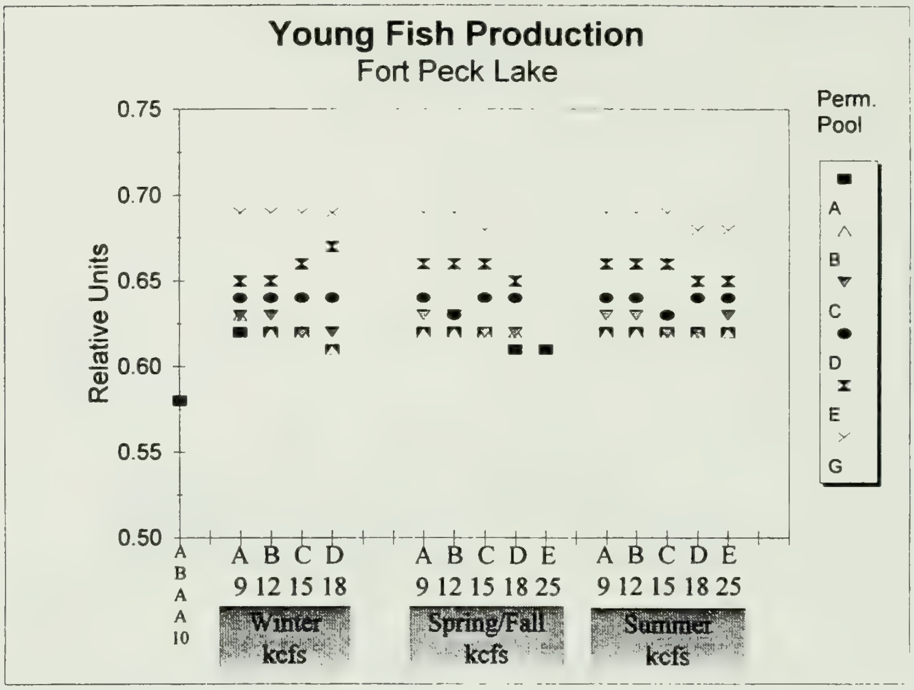

Figure 6-9. Annual index of total young fish production in Fort Peck Lake over the 96-year simulation period by nonnavigation service level.

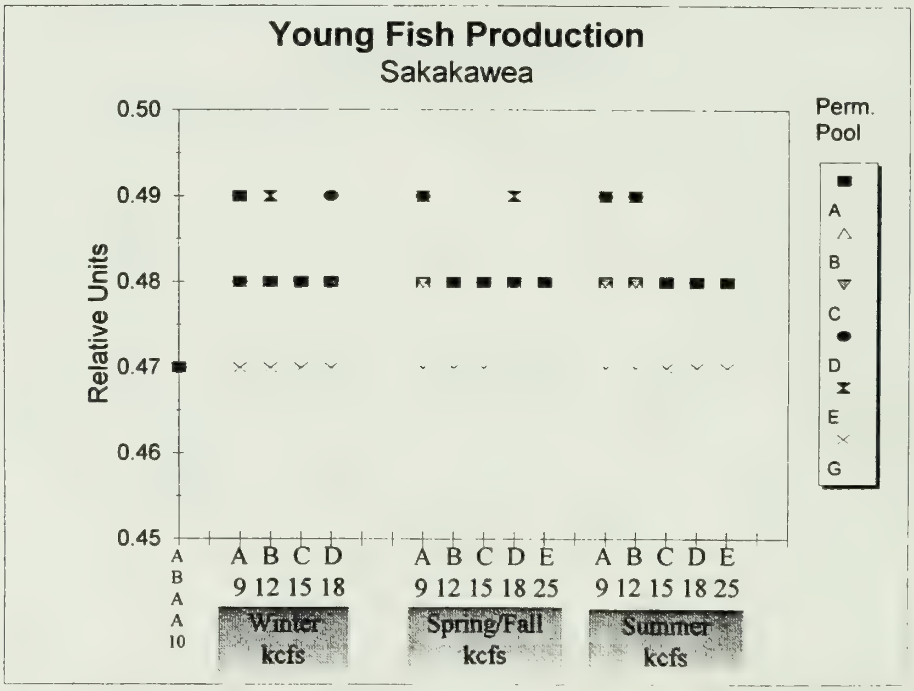

Figure 6-10. Annual index of total young fish production in Lake Sakakawea over the 96-year simulation period by nonnavigation service level.

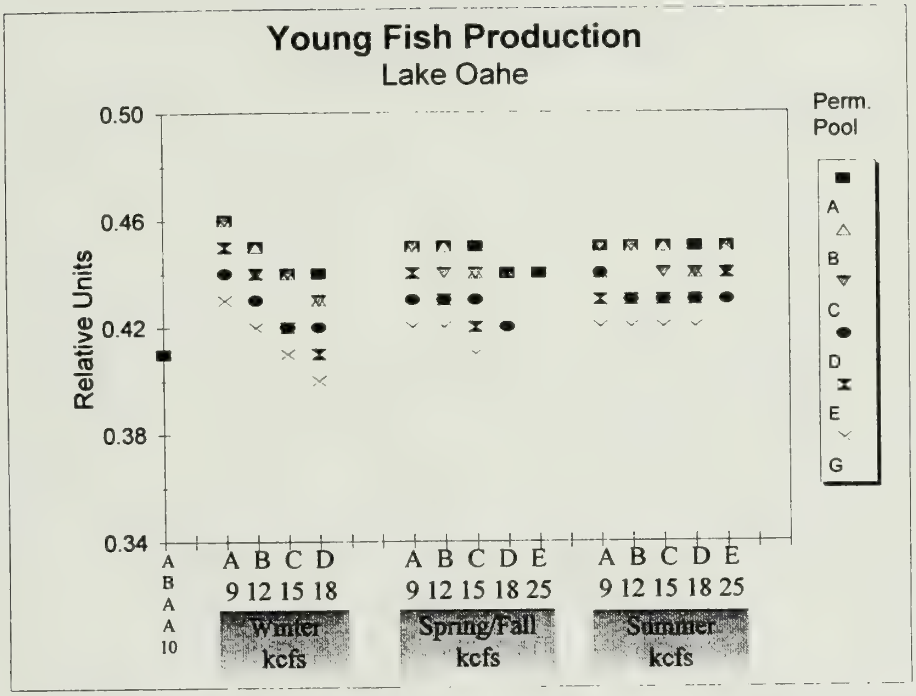

Figure 6-11. Annual index of total young fish production in Lake Oahe over the 96-year simulation period by nonnavigation service level.

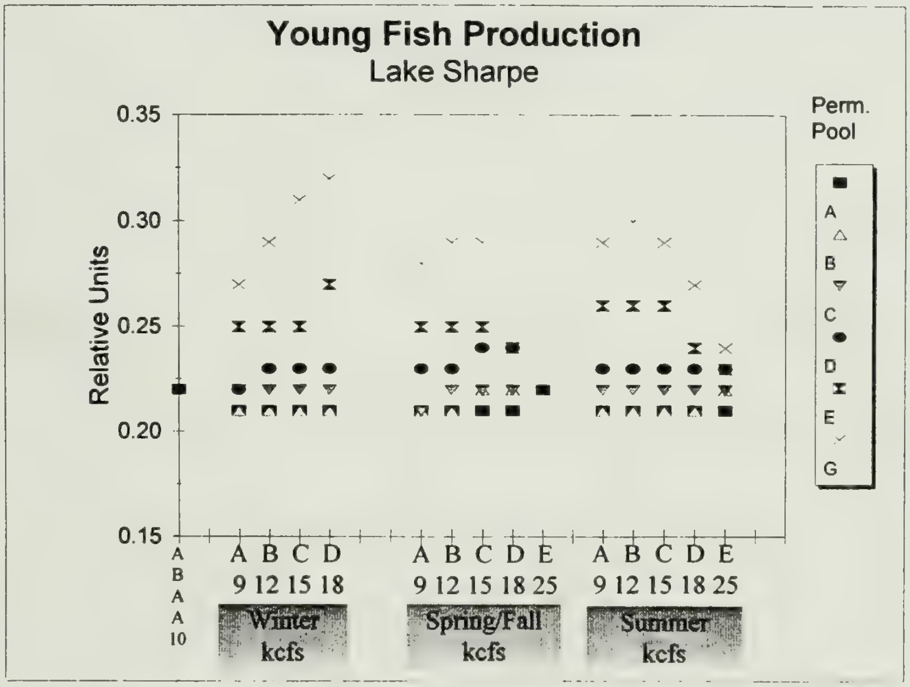

Figure 6-12. Annual index of total young fish production in Lake Sharpe over the 96-year simulation period by nonnavigation service level.

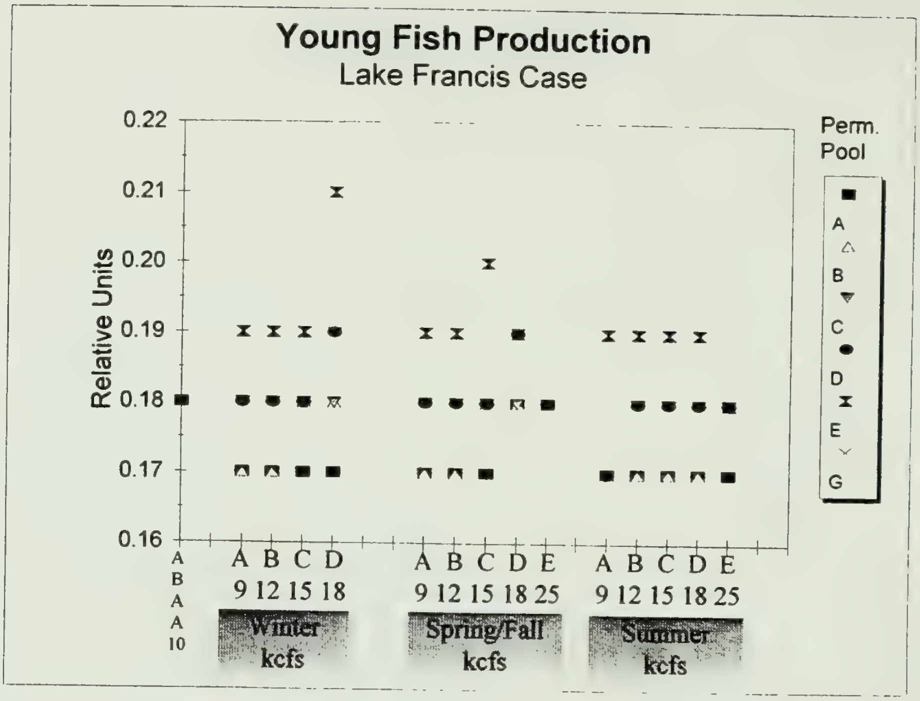

Figure 6-13. Annual index of total young fish production in Lake Francis Case over the 96-year simulation period by nonnavigation service level.

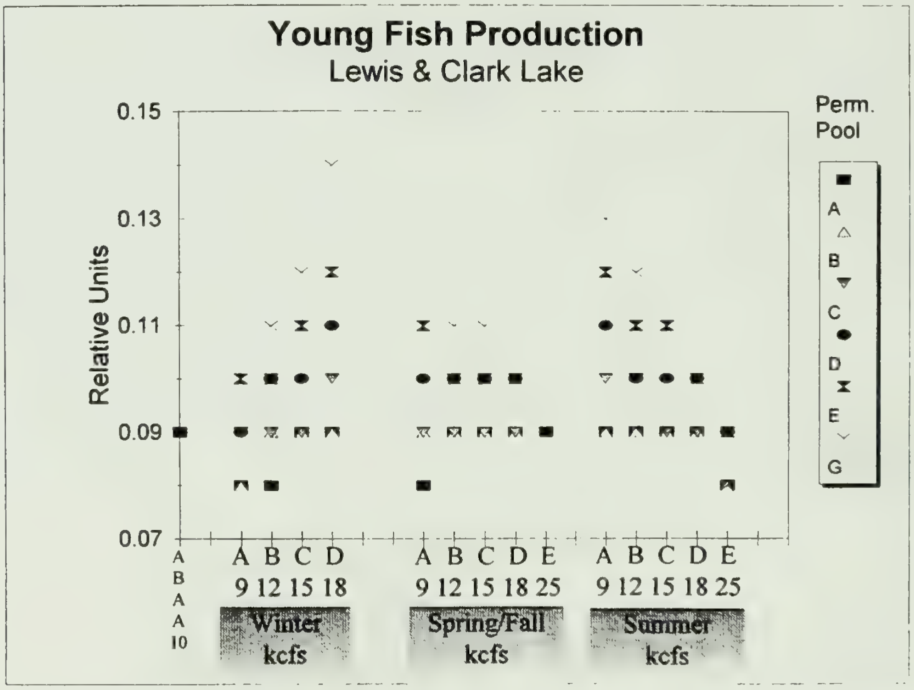

Figure 6-14. Annual index of total young fish production in Lewis and Clark Lake over the 96-year simulation period by nonnavigation service level.

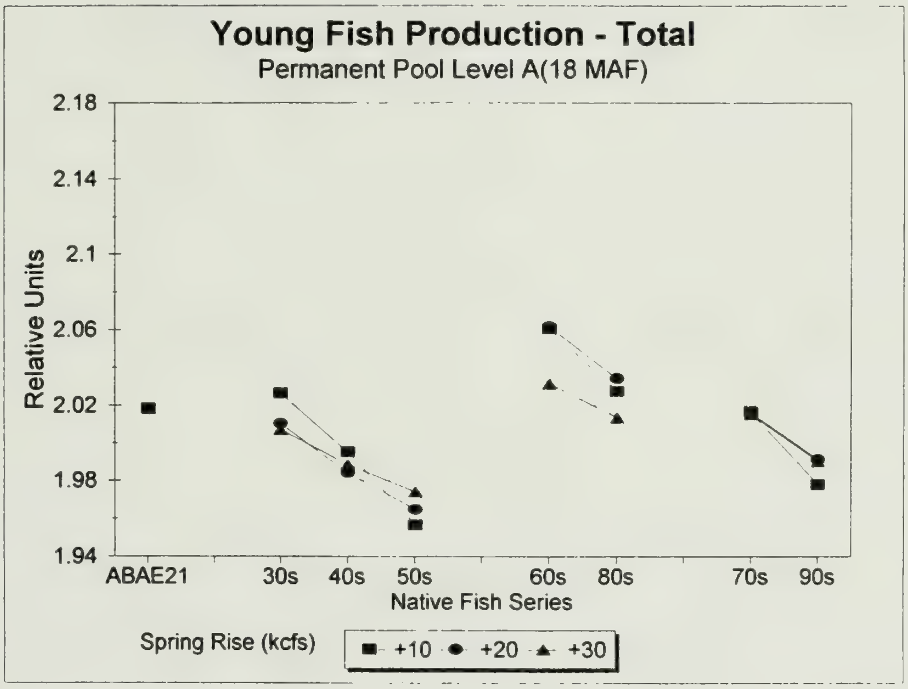

Figure 6-15. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

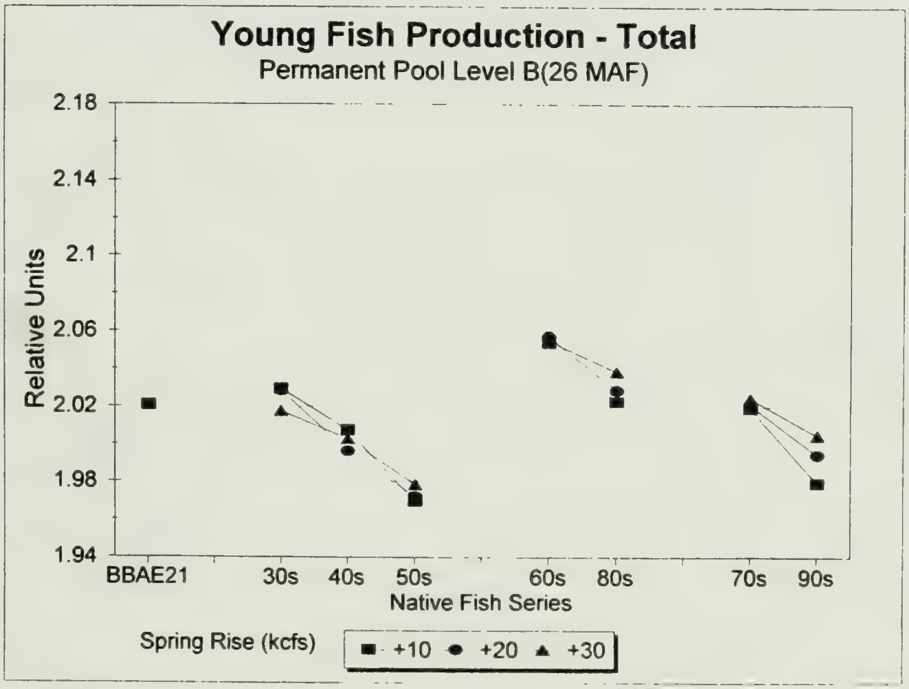

Figure 6-16. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

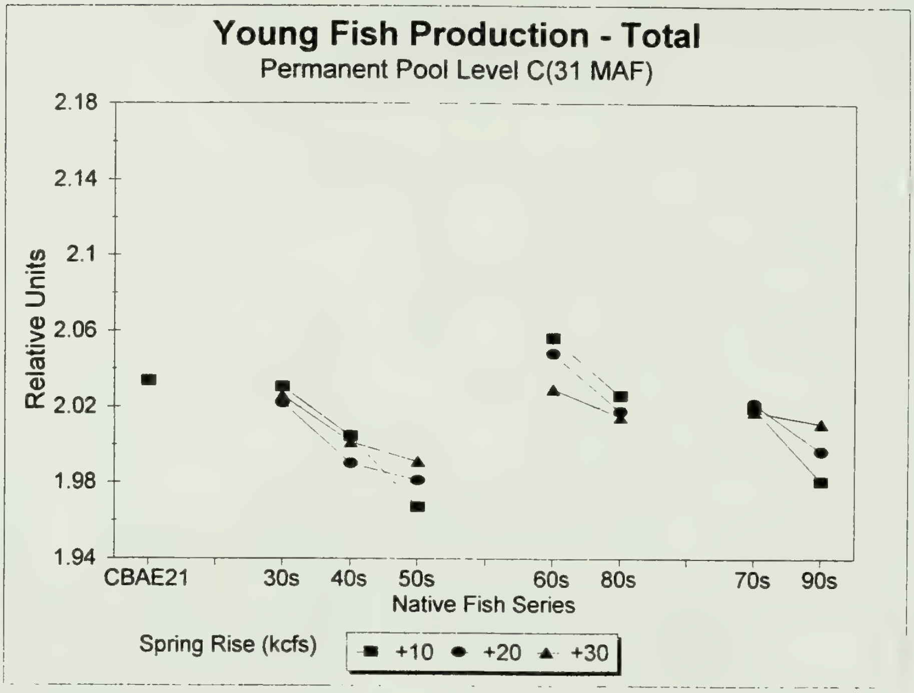

Figure 6-17. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

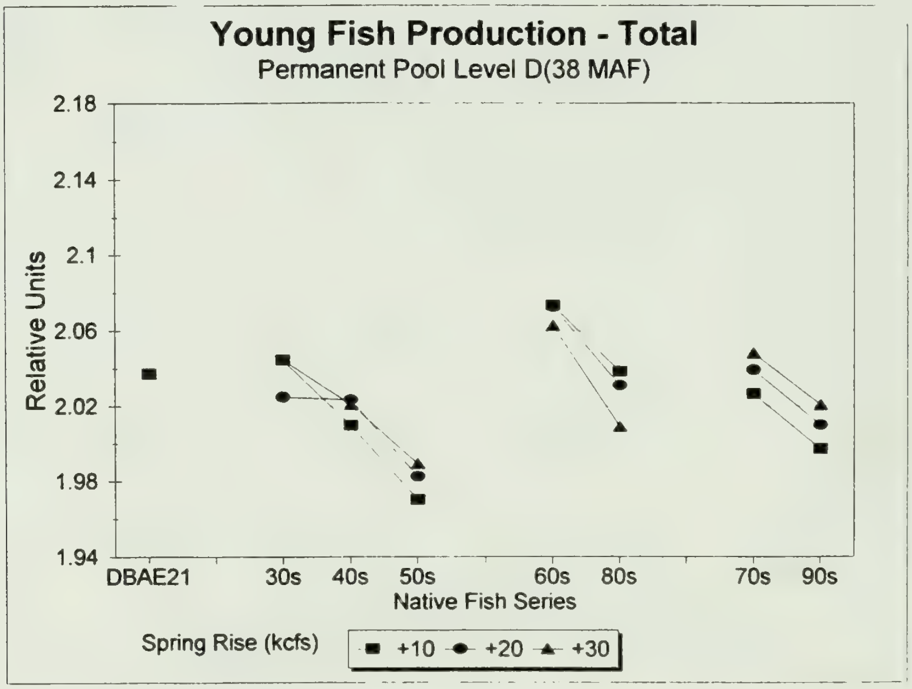

Figure 6-18. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

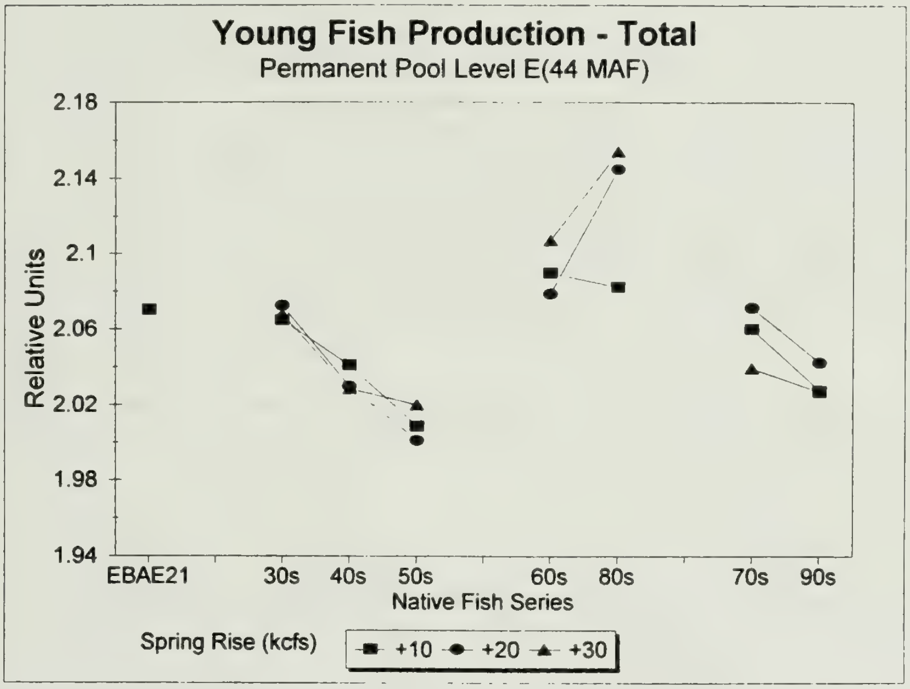

Figure 6-19. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

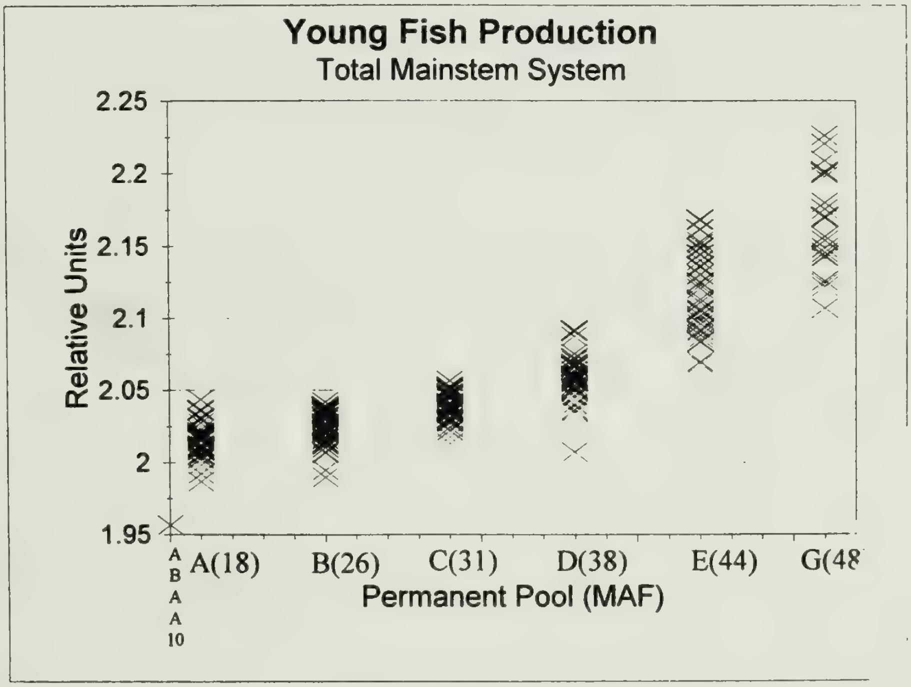

Figure 6-20. Average annual index of total young fish production in the six mainstem lakes over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

7.0 LAKE COLDWATER FISH HABITAT

Several factors relate to the amount of coldwater fish habitat retained through summer and fall in the upper three mainstem lakes. Higher lake levels, inflow, and outflow determine the extent of cold water retained through the summer and fall in these lakes (Corps, 1994d). The effects of these factors on average annual coldwater fish habitat over the 96-year simulation period for the 383 alternatives evaluated are shown in Table 7-1 at the end of the narrative section.

7.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

7.1.1 Total System

The modified navigation and intrasystem regulation criteria would increase the total coldwater fish habitat in the three upper mainstem lakes where most of the coldwater habitat prevails. The higher lake levels associated with the modified navigation criteria in drought periods lead to about 10 percent more average coldwater habitat over the 96-year simulation period (Table 7-2). The difference in coldwater habitat occurs primarily during droughts such as in the 1930s, late 1950s, and 1980s (Figure 7-1). The difference is substantial in early years of an extended drought and in years following a drought when lake levels are recovering. For example, in 1993 when the lake levels were recovering from a 5-year drought, coldwater habitat predicted by the model was about 4 MAF (50 percent) higher because of the higher lake levels provided by the modified navigation criteria. Modified intrasystem regulation has little effect on coldwater fish habitat in the total system (Table 7-2).

Table 7-2. Average annual amount of coldwater fish habitat for the six mainstem lakes over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total MAF	Fort Peck Lake	Lake Sakakawea	Lake Oahe
Current	Current	ABAA10	9.9	3.7	2.7	3.5
Modified	Current	ABAA20	10.9	4.1	3.1	3.7
Current	Modified	ABAA11	10.1	3.7	2.8	3.6
Modified	Modified	ABAA21	10.9	4.1	3.1	3.7

7.1.2 Fort Peck Lake

At Fort Peck Lake, coldwater fish habitat increases under the modified navigation criteria (Table 7-2; Figure 7-2), because lake levels are higher, especially during and following droughts of the 1930s, late 1950s, and late 1980s. In many of these drought years, the amount of coldwater fish habitat in the lake is nearly double that of the current navigation criteria. There is no long-term average difference in coldwater habitat with modified intrasystem regulation (Table 7-2; Figure 7-2). Modified intrasystem regulation leads to substantially higher amount of habitat in some drought years.

7.1.3 Lake Sakakawea

The patterns of coldwater fish habitat in Lake Sakakawea as they relate to the modified navigation and intrasystem regulation criteria (Figure 7-3) are similar to those for Fort Peck Lake.

7.1.4 Lake Oahe

The patterns of coldwater fish habitat in Lake Oahe as they relate to the modified navigation and intrasystem regulation criteria (Figure 7-4) are similar to those for Fort Peck Lake and Lake Sakakawea, except the magnitude of the differences is less.

7.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

7.2.1 Total System

Total coldwater fish habitat in the upper three lakes varies the most with winter minimum nonnavigation service levels (Figure 7-5). Higher winter minimum nonnavigation service levels lead to lower summer and fall lake levels in drought periods, especially at lower permanent pool levels. Lower lake levels in summer and fall lead to less coldwater fish habitat. At higher permanent pool levels, the effect of higher winter minimum nonnavigation service levels is less, because lake levels remain high causing coldwater habitat to also remain high and relatively unaffected. Higher spring through fall minimum nonnavigation service levels have a slight negative effect on coldwater habitat at lower permanent pool levels, because they too reduce lake levels slightly during drought periods.

7.2.2 Fort Peck Lake

The total system pattern was also apparent for Fort Peck Lake (Figure 7-6).

7.2.3 Lake Sakakawea

The total system pattern was also apparent for Lake Sakakawea (Figure 7-7).

7.2.4 Lake Oahe

The total system pattern was also apparent for Lake Oahe (Figure 7-8).

7.3 EFFECT OF NATIVE FISH SERIES

Increasing spring releases from storage would reduce total coldwater fish habitat in the upper three lakes at all permanent pool levels (Figures 7-9 through 7-13). Increasing spring releases would reduce storage levels in summer and fall sufficiently to decrease up to 10 percent of the amount of coldwater habitat retained over the summer and fall. The reduction occurs in drought and nondrought years. The effect is greatest for lower permanent pools because the spring releases are retained longer through drought periods with lower permanent pools than with higher permanent pools. Eliminating constraints on flood control for the spring releases further reduces coldwater habitat (Figures 7-9 through 7-13), because the lakes are further drawn down. Eliminating navigation in August and September increases long-term average coldwater habitat up to 6 to 10 percent (Figures 7-9 through 7-13), because lake levels remain higher over the late summer and fall.

7.4 PERMANENT POOL LEVEL

An increase in the permanent pool level increases total coldwater fish habitat in the upper three mainstem lakes up to 15 percent (Figure 7-14). The greatest amount of habitat occurs at the highest permanent pool levels: 38 and 44 MAF. Differences in habitat among permanent pool levels occur in drought periods when differences in permanent pool levels affect the amount of water in storage.

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ABAA10	9.9	3.7	2.7	3.5
ABAA11	10.1	3.7	2.8	3.6
ABAA20	10.9	4.1	3.1	3.7
AAAA21	11.1	4.2	3.2	3.8
AAAB21	11.1	4.2	3.2	3.8
AAAC21	11.1	4.2	3.2	3.8
AAAD21	11.1	4.2	3.2	3.8
AAAE21	11.1	4.2	3.2	3.8
AABB21	11.0	4.1	3.1	3.7
AABC21	11.0	4.1	3.1	3.7
AABD21	11.0	4.1	3.1	3.7
AABE21	11.0	4.1	3.1	3.7
AACC21	10.9	4.1	3.1	3.7
AACD21	10.9	4.1	3.1	3.7
AACE21	10.9	4.1	3.1	3.7
AADD21	10.9	4.1	3.1	3.7
AADE21	10.9	4.1	3.1	3.7
AAEE21	10.7	4.0	3.0	3.7
ABAA21	10.9	4.1	3.1	3.7
ABAB21	10.9	4.1	3.1	3.7
ABAC21	10.9	4.1	3.1	3.7
ABAD21	10.9	4.1	3.1	3.7
ABAE21	10.9	4.1	3.1	3.7
ABBB21	10.9	4.1	3.1	3.7
ABBC21	10.8	4.1	3.1	3.7
ABBD21	10.8	4.1	3.1	3.7
ABBE21	10.8	4.1	3.1	3.7
ABCC21	10.8	4.1	3.1	3.7
ABCD21	10.8	4.0	3.1	3.7
ABCE21	10.8	4.0	3.1	3.7
ABDD21	10.8	4.0	3.0	3.7
ABDE21	10.7	4.0	3.0	3.7
ACAA21	10.7	4.0	3.0	3.7
ACAB21	10.7	4.0	3.0	3.7
ACAC21	10.8	4.0	3.0	3.7
ACAD21	10.7	4.0	3.0	3.7
ACAE21	10.7	4.0	3.0	3.7
ACBB21	10.7	4.0	3.0	3.7

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ACBC21	10.7	4.0	3.0	3.7
ACBD21	10.7	4.0	3.0	3.7
ACBE21	10.7	4.0	3.0	3.7
ACCC21	10.7	4.0	3.0	3.7
ACCD21	10.6	4.0	3.0	3.7
ACCE21	10.7	4.0	3.0	3.7
ACDD21	10.6	4.0	3.0	3.7
ACDE21	10.6	4.0	3.0	3.6
ADAA21	10.6	4.0	3.0	3.6
ADAB21	10.6	4.0	3.0	3.6
ADAC21	10.7	4.0	3.0	3.6
ADAD21	10.6	4.0	3.0	3.6
ADAE21	10.6	4.0	3.0	3.6
ADBB21	10.6	4.0	3.0	3.6
ADBC21	10.5	4.0	3.0	3.6
ADBD21	10.6	4.0	3.0	3.6
ADBE21	10.6	4.0	3.0	3.6
ADCC21	10.6	4.0	3.0	3.6
ADCD21	10.5	3.9	2.9	3.6
ADCE21	10.4	3.9	2.9	3.6
ADDD21	10.5	3.9	2.9	3.6
ADDE21	10.4	3.9	2.9	3.6
BAAA21	11.1	4.2	3.2	3.8
BAAB21	11.1	4.2	3.2	3.8
BAAC21	11.1	4.2	3.2	3.8
BAAD21	11.1	4.2	3.2	3.8
BAAE21	11.1	4.2	3.2	3.8
BABB21	11.1	4.2	3.1	3.8
BABC21	11.1	4.2	3.1	3.8
BABD21	11.1	4.2	3.1	3.8
BABE21	11.1	4.2	3.1	3.8
BACC21	11.1	4.1	3.1	3.8
BACD21	11.0	4.1	3.1	3.8
BACE21	11.0	4.1	3.1	3.8
BADD21	11.0	4.1	3.1	3.8
BADE21	11.0	4.1	3.1	3.8
BBAA21	11.0	4.1	3.1	3.8
BBAB21	11.1	4.2	3.1	3.8

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
BBAC21	11.0	4.1	3.1	3.8
BBAD21	11.0	4.1	3.1	3.8
BBAE21	11.0	4.1	3.1	3.7
BBBB21	11.0	4.1	3.1	3.7
BBBC21	11.0	4.1	3.1	3.8
BBBD21	10.9	4.1	3.1	3.7
BBBE21	11.0	4.1	3.1	3.8
BBCC21	11.0	4.1	3.1	3.8
BBCD21	11.0	4.1	3.1	3.8
BBCE21	10.9	4.1	3.1	3.7
BBDD21	10.9	4.1	3.1	3.8
BBDE21	10.9	4.1	3.0	3.7
BCAA21	10.9	4.1	3.1	3.7
BCAB21	10.9	4.1	3.1	3.7
BCAC21	10.8	4.1	3.1	3.7
BCAD21	10.9	4.1	3.1	3.7
BCAE21	10.9	4.1	3.1	3.7
BCBB21	10.9	4.1	3.1	3.7
BCBC21	10.9	4.1	3.0	3.7
BCBD21	10.8	4.1	3.0	3.7
BCBE21	10.8	4.1	3.0	3.7
BCCC21	10.9	4.1	3.1	3.7
BCCD21	10.8	4.1	3.0	3.7
BCCE21	10.9	4.1	3.0	3.7
BCDD21	10.8	4.0	3.0	3.7
BCDE21	10.8	4.0	3.0	3.7
BDAA21	10.8	4.1	3.0	3.7
BDAB21	10.8	4.1	3.0	3.7
BDAC21	10.8	4.1	3.0	3.7
BDAD21	10.9	4.1	3.1	3.7
BDAE21	10.8	4.1	3.0	3.7
BDBB21	10.8	4.1	3.0	3.7
BDBC21	10.8	4.1	3.0	3.7
BDBD21	10.8	4.1	3.0	3.7
BDBE21	10.8	4.1	3.0	3.7
BDCC21	10.8	4.0	3.0	3.7
BDCD21	10.7	4.0	3.0	3.7
BDCE21	10.8	4.1	3.0	3.7

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
BDDD21	10.7	4.0	3.0	3.7
CAAA21	11.3	4.2	3.2	3.8
CAAB21	11.2	4.2	3.2	3.8
CAAC21	11.2	4.2	3.2	3.8
CAAD21	11.2	4.2	3.2	3.8
CAAE21	11.2	4.2	3.2	3.8
CABB21	11.3	4.3	3.2	3.8
CABC21	11.3	4.2	3.2	3.8
CABD21	11.3	4.2	3.2	3.8
CABE21	11.2	4.2	3.2	3.8
CACC21	11.2	4.2	3.2	3.8
CACD21	11.2	4.2	3.2	3.8
CACE21	11.2	4.2	3.2	3.8
CADD21	11.2	4.2	3.2	3.8
CADE21	11.2	4.2	3.2	3.8
CBAA21	11.2	4.2	3.2	3.8
CBAB21	11.2	4.2	3.2	3.8
CBAC21	11.2	4.2	3.2	3.8
CBAD21	11.2	4.2	3.2	3.8
CBAE21	11.1	4.2	3.2	3.8
CBBB21	11.2	4.2	3.2	3.8
CBBC21	11.2	4.2	3.2	3.8
CBBD21	11.2	4.2	3.2	3.8
CBBE21	11.2	4.2	3.2	3.8
CBCC21	11.2	4.2	3.2	3.8
CBCD21	11.1	4.2	3.1	3.8
CBCE21	11.1	4.2	3.2	3.8
CBDD21	11.3	4.2	3.2	3.9
CBDE21	11.1	4.2	3.1	3.8
CCAA21	11.1	4.2	3.2	3.8
CCAB21	11.1	4.2	3.1	3.8
CCAC21	11.0	4.2	3.1	3.7
CCAD21	11.0	4.2	3.1	3.7
CCAE21	11.1	4.2	3.1	3.8
CCBB21	11.1	4.2	3.1	3.8
CCBC21	11.1	4.2	3.1	3.8
CCBD21	11.0	4.1	3.1	3.8
CCBE21	11.1	4.2	3.1	3.8

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
CCCC21	11.1	4.2	3.1	3.8
CCCD21	11.2	4.2	3.1	3.8
CCCE21	11.0	4.2	3.1	3.8
CCDD21	11.1	4.2	3.1	3.8
CDAA21	11.0	4.2	3.1	3.8
CDAB21	11.0	4.1	3.1	3.7
CDAC21	10.9	4.1	3.1	3.7
CDAD21	11.0	4.2	3.1	3.8
CDAE21	11.0	4.2	3.1	3.7
CDBB21	11.0	4.1	3.1	3.8
CDBC21	11.0	4.1	3.1	3.7
CDBD21	11.1	4.2	3.1	3.8
CDBE21	11.0	4.2	3.1	3.8
CDCC21	11.0	4.1	3.1	3.8
CDCD21	11.1	4.2	3.1	3.8
CDDD21	11.0	4.2	3.1	3.8
DAAA21	11.5	4.3	3.3	3.9
DAAB21	11.4	4.3	3.3	3.9
DAAC21	11.4	4.3	3.3	3.9
DAAD21	11.5	4.3	3.3	3.9
DAAE21	11.4	4.3	3.2	3.9
DABB21	11.5	4.3	3.3	3.9
DABC21	11.4	4.3	3.3	3.9
DABD21	11.4	4.3	3.2	3.9
DABE21	11.4	4.3	3.2	3.9
DACC21	11.6	4.3	3.3	3.9
DACD21	11.6	4.3	3.3	3.9
DACE21	11.5	4.3	3.3	3.9
DADD21	11.6	4.3	3.3	3.9
DBAA21	11.6	4.3	3.4	3.9
DBAB21	11.6	4.4	3.3	3.9
DBAC21	11.6	4.3	3.3	3.9
DBAD21	11.5	4.3	3.3	3.9
DBAE21	11.4	4.3	3.2	3.9
DBBB21	11.5	4.3	3.3	3.9
DBBC21	11.5	4.3	3.3	3.9
DBBD21	11.5	4.3	3.3	3.9
DBBE21	11.5	4.3	3.3	3.9

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
DBCC21	11.4	4.3	3.3	3.9
DBCD21	11.6	4.4	3.3	3.9
DBDD21	11.5	4.3	3.3	3.9
DCAA21	11.5	4.3	3.3	3.9
DCAB21	11.4	4.3	3.3	3.9
DCAC21	11.4	4.3	3.3	3.9
DCAD21	11.4	4.3	3.2	3.8
DCAE21	11.4	4.3	3.2	3.9
DCBB21	11.4	4.3	3.3	3.9
DCBC21	11.4	4.3	3.2	3.9
DCBD21	11.3	4.2	3.2	3.8
DCBE21	11.6	4.4	3.3	3.9
DCCC21	11.5	4.3	3.2	3.9
DCCD21	11.5	4.3	3.3	3.9
DCDD21	11.7	4.4	3.3	4.0
DDAA21	11.4	4.3	3.3	3.9
DDAB21	11.6	4.3	3.3	3.9
DDAC21	11.4	4.3	3.3	3.9
DDAD21	11.4	4.3	3.2	3.9
DDAE21	11.5	4.4	3.3	3.9
DDBB21	11.3	4.3	3.2	3.9
DDBC21	11.4	4.3	3.2	3.9
DDBD21	11.5	4.3	3.3	3.9
DDCC21	11.5	4.3	3.2	3.9
DDCD21	11.7	4.4	3.4	4.0
EAAA21	12.1	4.5	3.6	4.0
EAAB21	12.0	4.5	3.6	4.0
EAAC21	12.0	4.5	3.5	4.0
EAAD21	11.9	4.5	3.5	4.0
EAAE21	11.7	4.4	3.4	3.9
EABB21	12.0	4.5	3.6	4.0
EABC21	11.9	4.5	3.5	4.0
EABD21	11.9	4.5	3.5	4.0
EABE21	11.8	4.4	3.4	3.9
EACC21	11.8	4.4	3.4	4.0
EACD21	11.8	4.4	3.4	4.0
EADD21	11.8	4.4	3.4	4.0
EBAA21	12.0	4.5	3.5	4.0

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
EBAB21	12.0	4.5	3.5	4.0
EBAC21	12.0	4.5	3.5	4.0
EBAD21	11.8	4.4	3.4	3.9
EBAE21	11.8	4.4	3.4	3.9
EBBB21	12.1	4.5	3.6	4.0
EBBC21	11.9	4.5	3.5	4.0
EBBD21	11.8	4.4	3.4	3.9
EBCC21	12.0	4.5	3.5	4.0
EBCD21	11.8	4.4	3.4	3.9
ECAA21	12.0	4.5	3.6	4.0
ECAB21	12.0	4.5	3.5	4.0
ECAC21	11.9	4.5	3.5	3.9
ECAD21	12.0	4.5	3.5	4.0
ECBB21	11.9	4.5	3.5	4.0
ECBC21	12.0	4.5	3.5	4.0
ECBD21	11.8	4.4	3.4	3.9
ECCC21	12.1	4.5	3.5	4.0
ECCD21	12.1	4.5	3.5	4.0
EDAA21	12.2	4.5	3.6	4.0
EDAB21	12.2	4.6	3.6	4.0
EDAC21	12.1	4.5	3.5	4.0
EDBB21	12.1	4.5	3.5	4.0
EDBC21	12.0	4.5	3.5	4.0
EDBD21	12.1	4.6	3.5	4.0
EDCC21	12.1	4.5	3.5	4.0
GAAA21	12.3	4.6	3.7	4.0
GAAB21	12.5	4.6	3.8	4.1
GAAC21	12.4	4.6	3.7	4.1
GAAD21	12.2	4.6	3.6	4.0
GAAE21	12.2	4.6	3.6	4.0
GABB21	12.5	4.6	3.8	4.1
GABC21	12.5	4.6	3.7	4.1
GABD21	12.4	4.6	3.7	4.1
GACC21	12.4	4.6	3.7	4.1
GACD21	12.3	4.6	3.6	4.1
GBAA21	12.5	4.6	3.7	4.1
GBAB21	12.5	4.6	3.8	4.1
GBAC21	12.4	4.6	3.7	4.1

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
GBAD21	12.3	4.6	3.7	4.1
GBBB21	12.5	4.6	3.7	4.2
GBBC21	12.4	4.6	3.7	4.1
GBBD21	12.2	4.6	3.6	4.1
GBCC21	12.3	4.6	3.6	4.1
GCAA21	12.6	4.6	3.8	4.1
GCAB21	12.5	4.6	3.7	4.1
GCAC21	12.4	4.6	3.7	4.1
GCAD21	12.3	4.6	3.6	4.1
GCBB21	12.4	4.6	3.7	4.1
GDAA21	12.5	4.6	3.7	4.1
ABAE31	10.8	4.0	3.1	3.7
BBAE31	11.0	4.1	3.1	3.8
CBAE31	11.1	4.1	3.1	3.8
DBAE31	11.4	4.2	3.3	3.9
EBAE31	11.8	4.4	3.5	3.9
ABAE32	10.5	3.9	3.0	3.6
BBAE32	10.7	4.0	3.0	3.7
CBAE32	10.8	4.0	3.0	3.7
DBAE32	11.1	4.2	3.2	3.8
EBAE32	11.6	4.3	3.4	3.9
ABAE33	10.1	3.8	2.8	3.5
BBAE33	10.3	3.9	2.9	3.6
CBAE33	10.5	3.9	2.9	3.6
DBAE33	10.9	4.1	3.1	3.7
EBAE33	11.4	4.3	3.3	3.8
ABAE41	10.7	4.0	3.1	3.7
BBAE41	11.0	4.1	3.1	3.7
CBAE41	11.0	4.1	3.1	3.8
DBAE41	11.3	4.2	3.3	3.8
EBAE41	11.7	4.4	3.4	3.9
ABAE42	10.3	3.9	2.9	3.6
BBAE42	10.5	3.9	2.9	3.6
CBAE42	10.6	4.0	2.9	3.6
DBAE42	11.1	4.2	3.2	3.8
EBAE42	11.4	4.3	3.3	3.8
ABAE43	10.0	3.7	2.8	3.5
BBAE43	10.1	3.8	2.8	3.5

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
CBAE43	10.3	3.9	2.9	3.6
DBAE43	10.7	4.0	3.0	3.7
EBAE43	11.2	4.3	3.2	3.7
ABAE51	10.6	4.0	3.0	3.6
BBAE51	10.8	4.1	3.1	3.7
CBAE51	10.9	4.1	3.1	3.7
DBAE51	11.2	4.2	3.2	3.8
EBAE51	11.6	4.4	3.4	3.9
ABAE52	10.3	3.9	2.9	3.5
BBAE52	10.4	3.9	2.9	3.6
CBAE52	10.6	4.0	3.0	3.6
DBAE52	11.1	4.2	3.2	3.7
EBAE52	11.3	4.2	3.3	3.8
ABAE53	9.9	3.7	2.7	3.4
BBAE53	10.0	3.8	2.7	3.5
CBAE53	10.2	3.9	2.8	3.5
DBAE53	10.6	4.0	3.0	3.6
EBAE53	11.0	4.1	3.2	3.7
ABAE61	11.8	4.2	3.5	4.0
BBAE61	11.9	4.3	3.6	4.0
CBAE61	12.0	4.3	3.6	4.1
DBAE61	12.5	4.5	3.9	4.2
EBAE61	12.8	4.6	3.9	4.2
ABAE62	11.2	4.0	3.3	3.9
BBAE62	11.4	4.1	3.4	3.9
CBAE62	11.7	4.2	3.5	4.0
DBAE62	12.0	4.3	3.6	4.0
EBAE62	12.6	4.7	3.9	4.1
ABAE63	10.8	3.9	3.1	3.8
BBAE63	11.0	4.0	3.2	3.8
CBAE63	11.2	4.1	3.3	3.8
DBAE63	11.4	4.1	3.4	3.9
EBAE63	12.2	4.5	3.7	4.0
ABAE71	10.9	4.1	3.1	3.7
BBAE71	11.0	4.1	3.2	3.7
CBAE71	11.1	4.2	3.2	3.7
DBAE71	11.5	4.3	3.4	3.8
EBAE71	11.9	4.5	3.5	3.9

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ABAE72	10.4	3.9	3.0	3.5
BBAE72	10.6	4.0	3.0	3.6
CBAE72	10.7	4.0	3.1	3.6
DBAE72	11.1	4.1	3.2	3.7
EBAE72	11.5	4.3	3.4	3.8
ABAE73	10.0	3.8	2.8	3.4
BBAE73	10.2	3.8	2.9	3.4
CBAE73	10.2	3.9	2.9	3.5
DBAE73	10.7	4.0	3.0	3.6
EBAE73	11.0	4.2	3.2	3.6
ABAE81	11.6	4.2	3.5	4.0
BBAE81	11.8	4.2	3.6	4.0
CBAE81	11.9	4.3	3.6	4.0
DBAE81	12.5	4.5	3.8	4.1
EBAE81	13.2	4.9	4.1	4.2
ABAE82	11.1	4.0	3.3	3.8
BBAE82	11.3	4.1	3.3	3.9
CBAE82	11.6	4.2	3.5	3.9
DBAE82	11.8	4.3	3.6	4.0
EBAE82	13.2	4.9	4.1	4.2
ABAE83	10.6	3.9	3.1	3.7
BBAE83	10.8	4.0	3.2	3.7
CBAE83	11.1	4.0	3.2	3.8
DBAE83	11.4	4.2	3.3	3.8
EBAE83	13.0	4.8	4.1	4.1
ABAE91	10.8	4.1	3.1	3.6
BBAE91	10.9	4.1	3.1	3.7
CBAE91	11.1	4.2	3.2	3.7
DBAE91	11.4	4.3	3.3	3.8
EBAE91	11.9	4.5	3.5	3.9
ABAE92	10.3	3.9	2.9	3.5
BBAE92	10.4	3.9	3.0	3.5
CBAE92	10.6	4.0	3.0	3.6
DBAE92	10.9	4.1	3.2	3.6
EBAE92	11.4	4.3	3.3	3.7
ABAE93	9.8	3.7	2.7	3.4
BBAE93	10.0	3.8	2.8	3.4
CBAE93	10.2	3.9	2.9	3.5

Table 7-1. Average annual coldwater fish habitat in mainstem lakes over the 96-year simulation period (in million acre-feet).

Alternative	Total for all Lakes	Fort Peck Lake	Lake Sakakawea	Lake Oahe
DBAE93	10.5	4.0	3.0	3.6
EBAE93	11.1	4.3	3.2	3.6
EVQ2XX	11.4	4.3	3.4	3.6

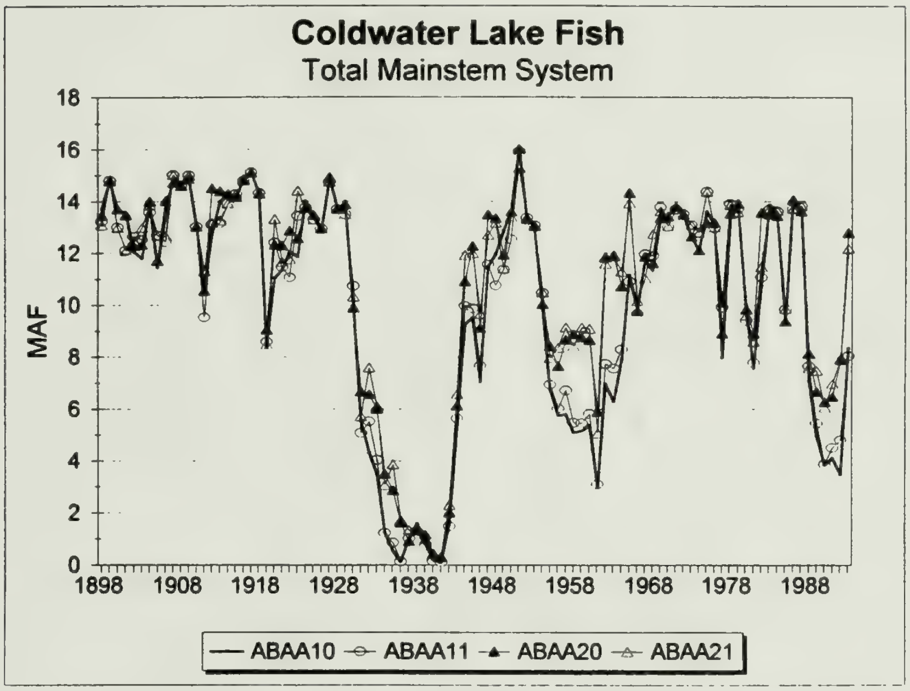

Figure 7-1. Annual average volume of coldwater fish habitat in three upper mainstem lakes over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

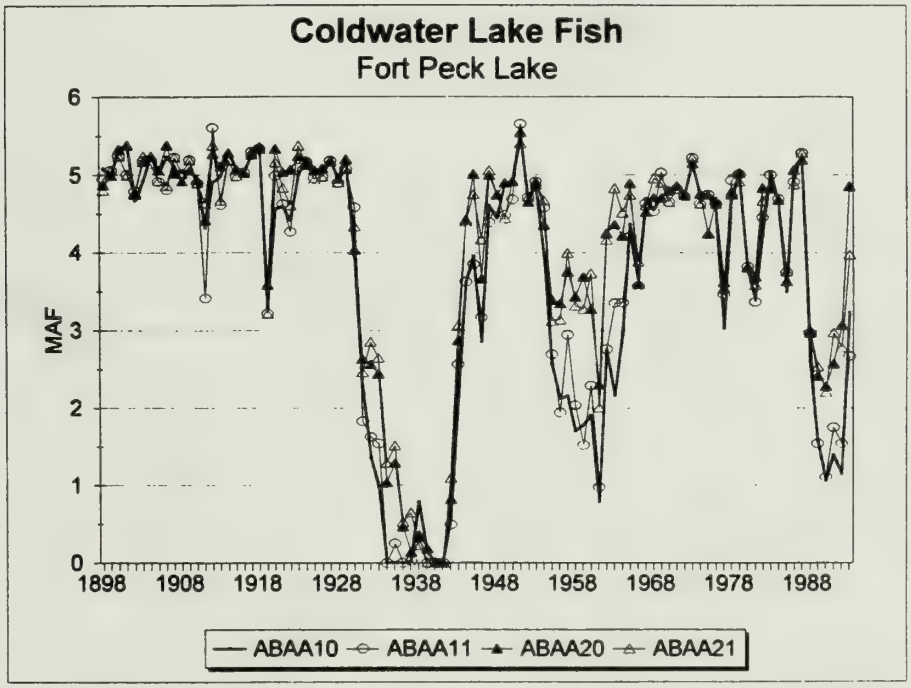

Figure 7-2. Annual average volume of coldwater fish habitat in Fort Peck Lake over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

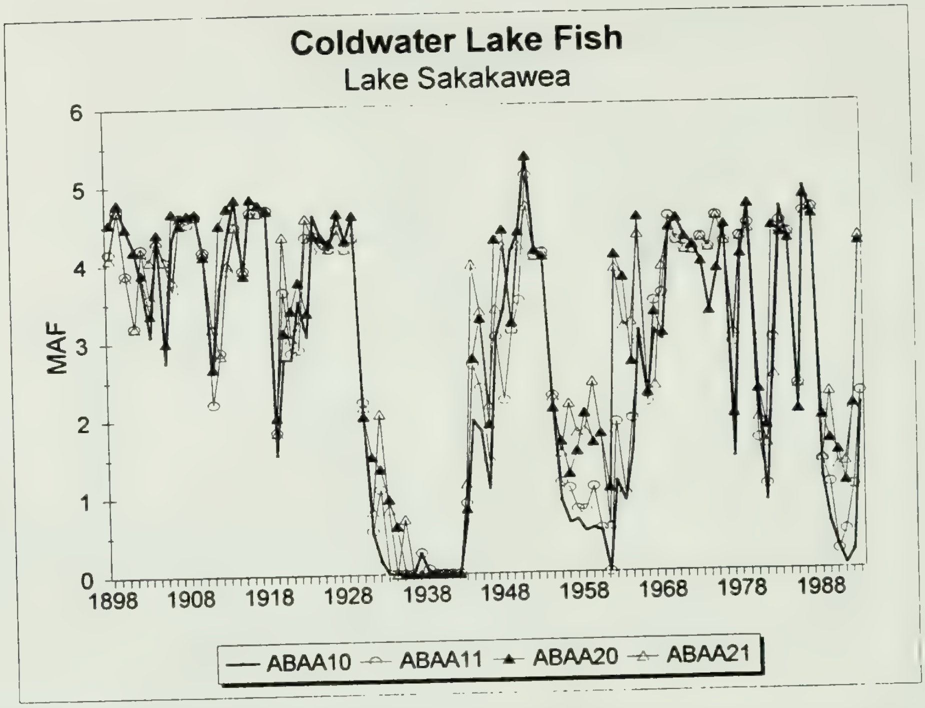

Figure 7-3. Annual average volume of coldwater fish habitat in Lake Sakakawea over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

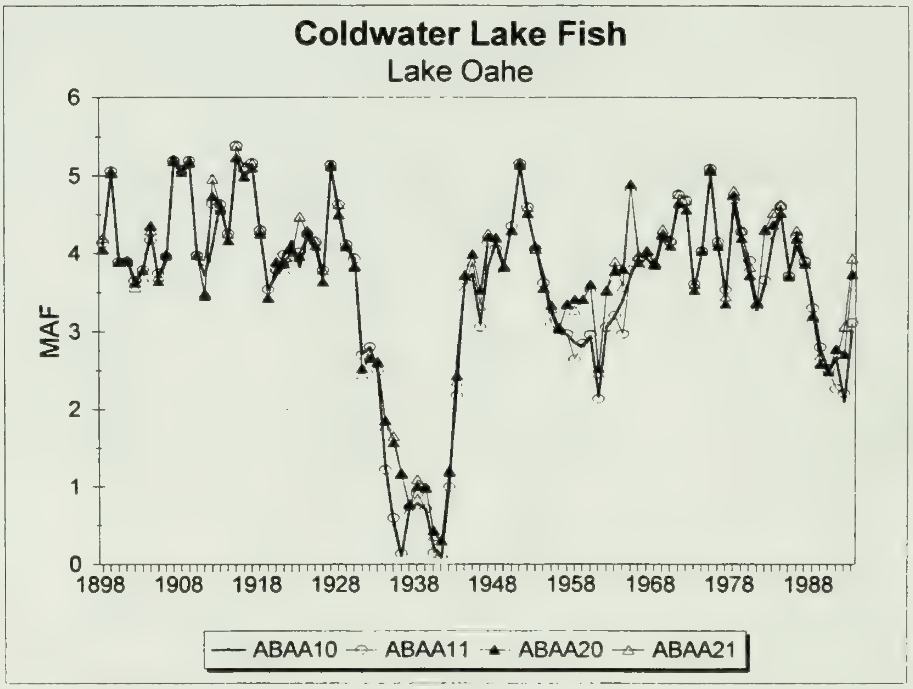

Figure 7-4. Annual average volume of coldwater fish habitat in Lake Oahe over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

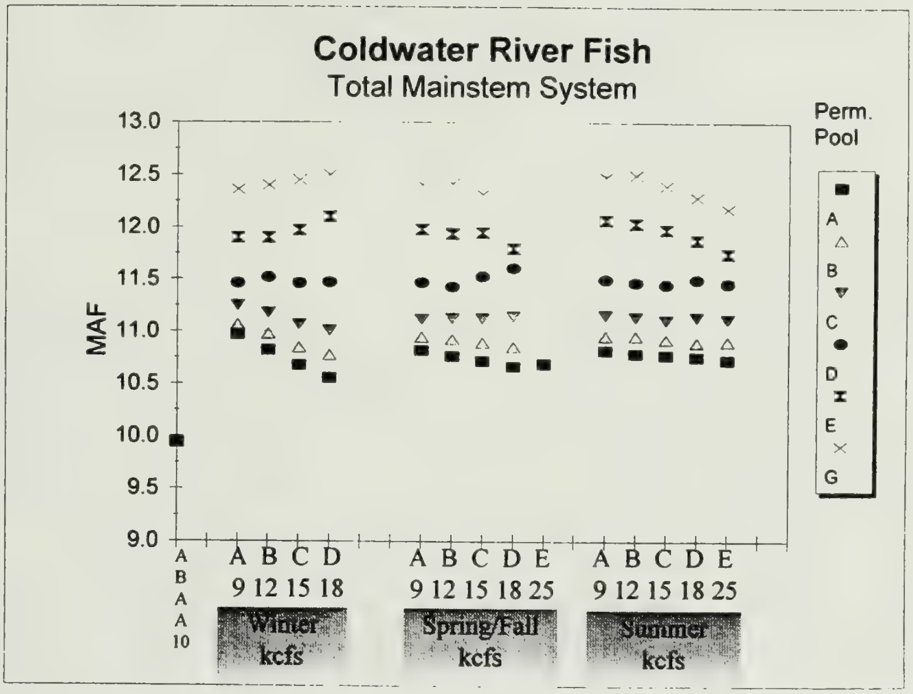

Figure 7-5. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period by nonnavigation service level.

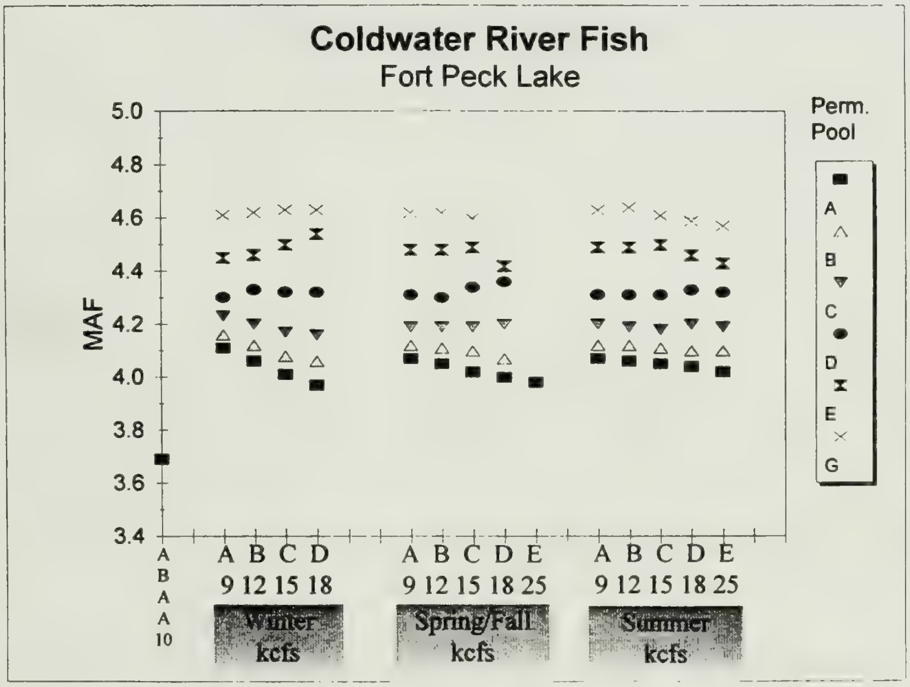

Figure 7-6. Annual average volume of coldwater fish habitat in Fort Peck Lake over the 96-year simulation period by nonnavigation service level.

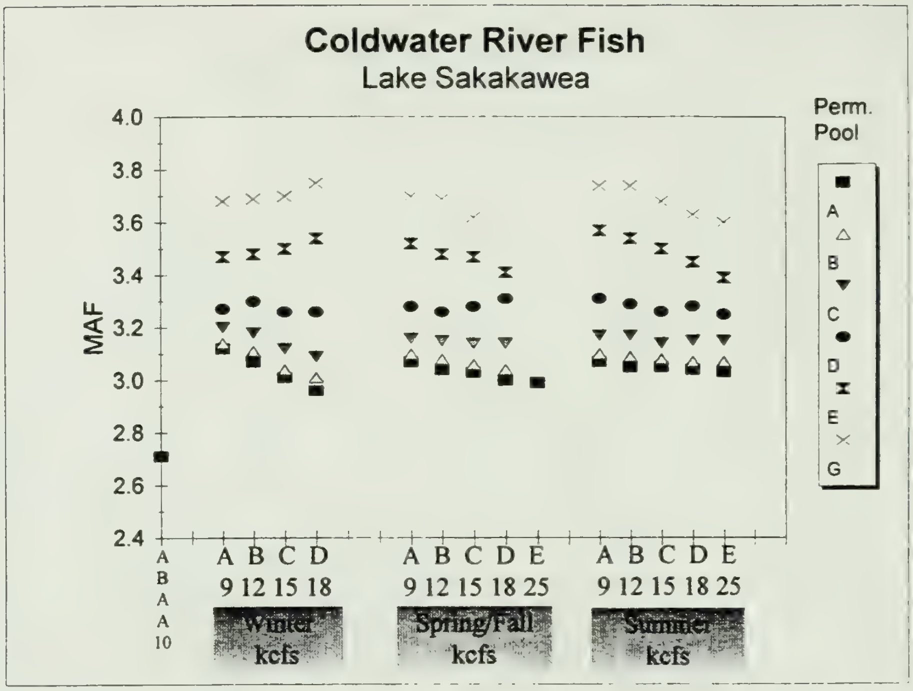

Figure 7-7. Annual average volume of coldwater fish habitat in Lake Sakakawea over the 96-year simulation period by nonnavigation service level.

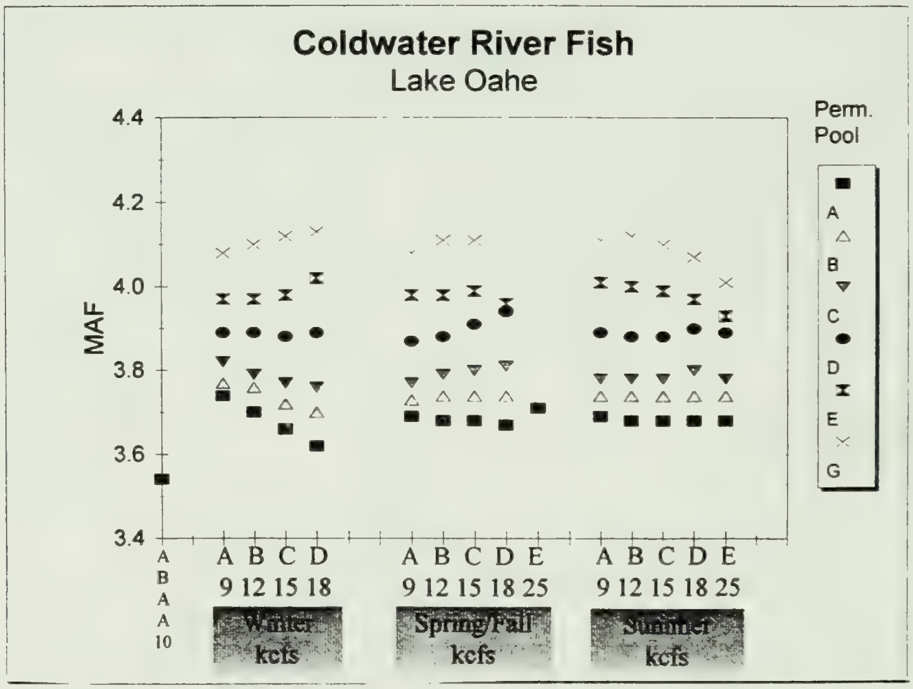

Figure 7-8. Annual average volume of coldwater fish habitat in Lake Oahe over the 96-year simulation period by nonnavigation service level.

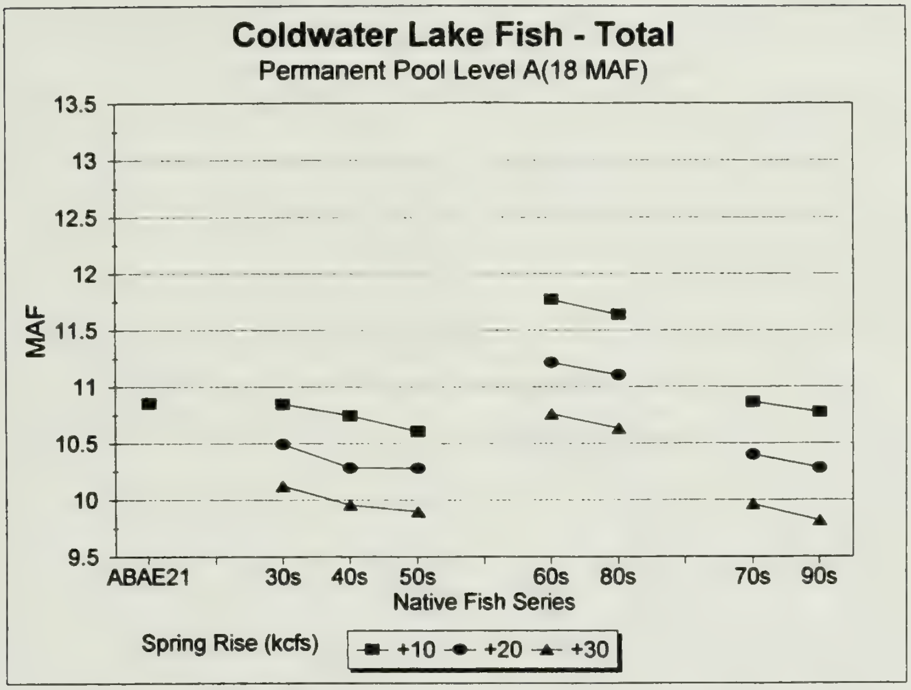

Figure 7-9. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

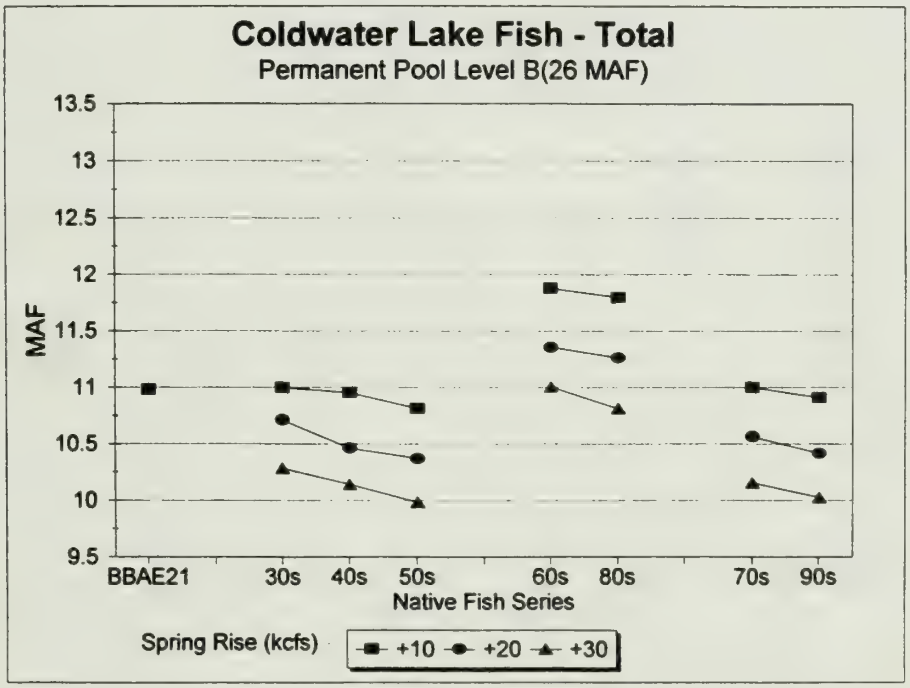

Figure 7-10. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

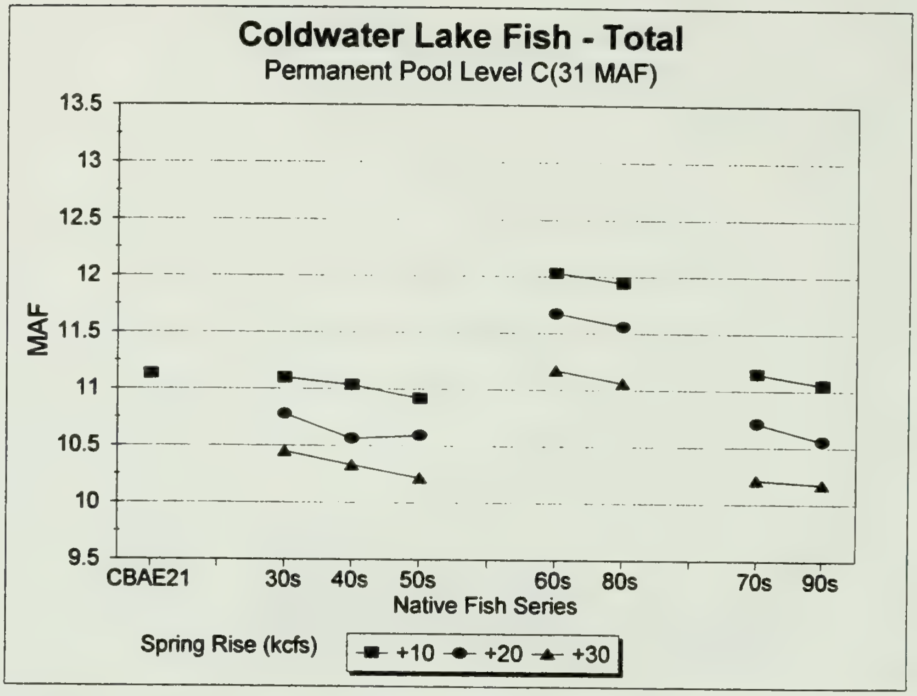

Figure 7-11. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

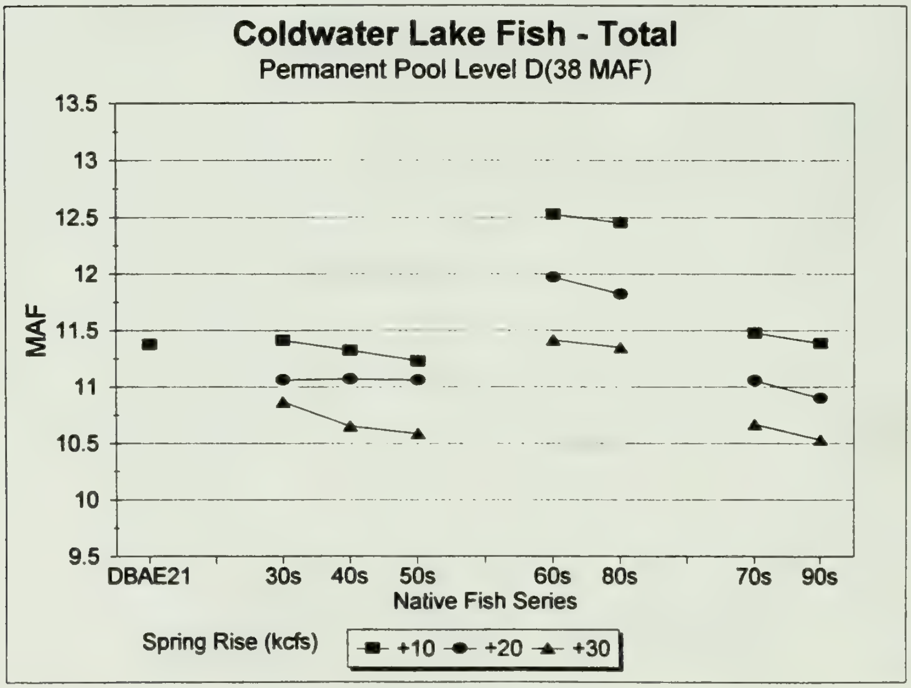

Figure 7-12. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

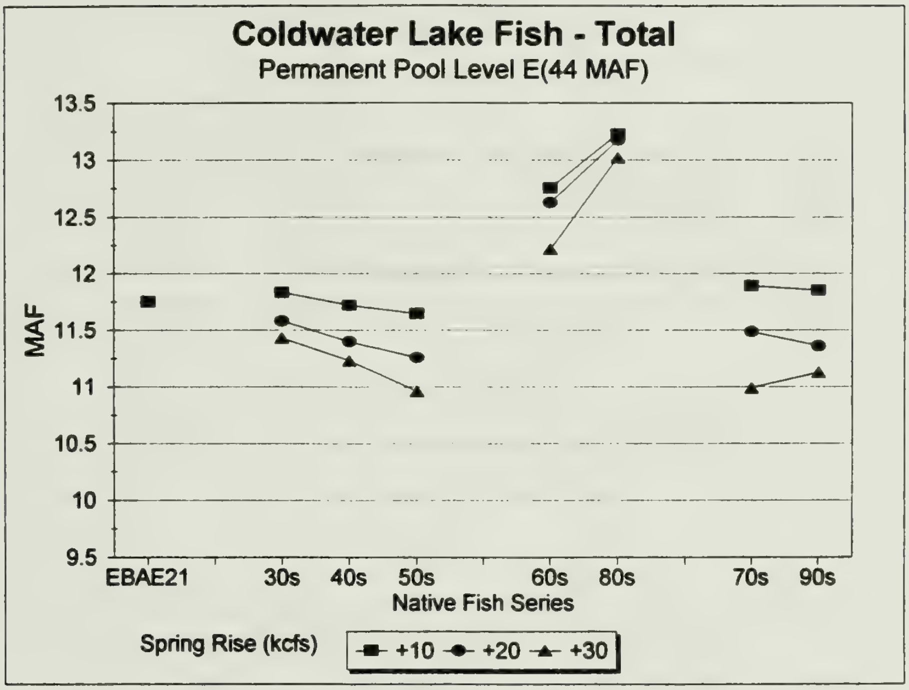

Figure 7-13. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

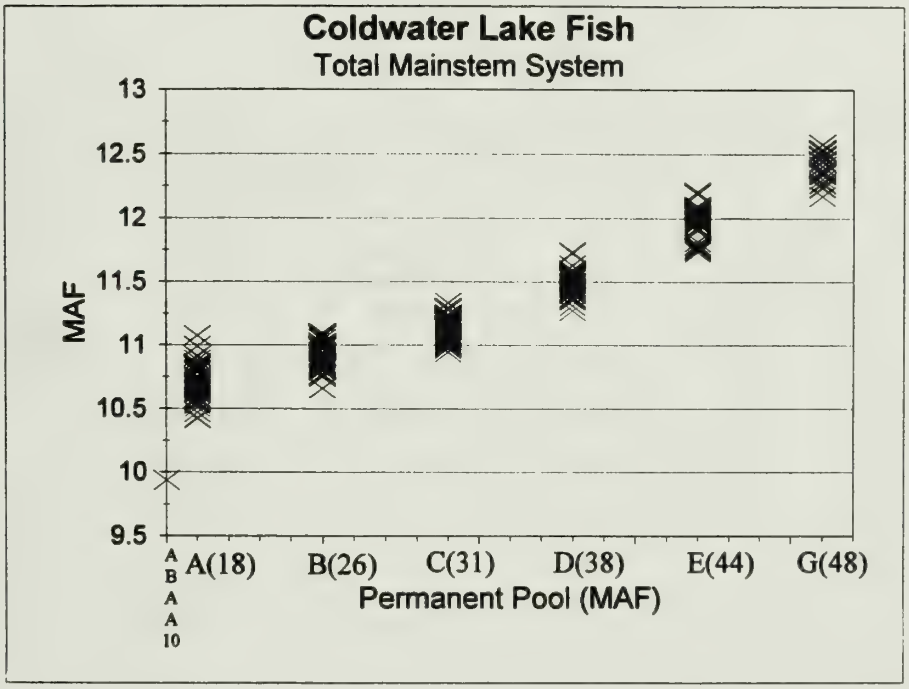

Figure 7-14. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

8.0 RIVER COLDWATER FISH HABITAT

The number of miles of coldwater fish habitat in the Missouri River below Fort Peck Dam and Garrison Dam was estimated for the 96-year simulation period for all alternatives (see Table 8-1 at the end of the narrative section). A temperature regression model was developed that uses storage releases, meteorology conditions, and lake levels to estimate the temperature of release water and warming downstream of the dam (Corps, 1994e). The average number of miles of coldwater habitat for each month of the year from July through October was estimated.

8.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

8.1.1 Total System

The modified navigation and intrasystem regulation criteria would have a mixed effect on total coldwater fish habitat below the upper two mainstem lakes. The higher lake levels associated with the modified navigation criteria in drought periods lead to about 4 percent higher average number of miles of coldwater fish habitat over the 96-year simulation period (Table 8-2). As Figure 8-1 shows, the difference occurs in drought periods (1930s, late 1950s, and late 1980s). Modified intrasystem regulation reduces the number of river miles slightly (1 to 2 percent), with the reduction occurring sporadically over the 96-year simulation period.

Table 8-2. Average annual number of miles of coldwater fish habitat below the mainstem lakes over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total Index	Below Fort Peck Dam	Below Garrison Dam
Current	Current	ABAA10	187	144	44
Modified	Current	ABAA20	194	147	46
Current	Modified	ABAA11	184	142	42
Modified	Modified	ABAA21	190	145	45

8.1.2 Missouri River Below Fort Peck Dam

Below Fort Peck Dam, the miles of coldwater habitat are higher under the modified navigation criteria (Table 8-2; Figure 8-2), because lake levels would be higher especially during and following drought periods (1930s, late 1950s, and late 1980s). There is a slightly lower amount (1 percent) of coldwater river habitat with modified intrasystem regulation (Table 8-2; Figure 8-2).

8.1.3 Missouri River Below Garrison Dam

As below Fort Peck Dam, the average number miles of coldwater habitat increases below Garrison Dam with the modified navigation criteria (Table 8-2; Figure 8-3). Again, the difference occurs primarily during and following drought periods. Modified intrasystem regulation leads to sporadically lower (up to 10 to 20 miles in some drought years) average number of river miles of coldwater habitat per year (July through October).

8.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

8.2.1 Total System

Total coldwater fish habitat in the Missouri River below the upper two mainstem lakes declines slightly at lower permanent pools with higher minimum nonnavigation service levels (Figure 8-4). As described above for coldwater lake habitat, higher minimum nonnavigation service levels lead to lower summer through fall lake levels, which in turn causes less coldwater habitat in the lakes and decreased releases to the river below the lakes. At lower pool levels in drought periods, higher minimum nonnavigation service levels can reduce the amount of cold water retained in the lakes over the summer and fall, and thus released to the river. At higher permanent pools, the amount of coldwater habitat is relatively unaffected by changes in minimum nonnavigation service level.

8.2.2 Missouri River Below Fort Peck Dam

The total system pattern is also apparent below Fort Peck Dam (Figure 8-5).

8.2.3 Missouri River Below Garrison Dam

The pattern below Garrison Dam is also similar to that of the total system (Figure 8-6).

8.3 EFFECT OF NATIVE FISH SERIES

Increasing spring releases from storage would reduce total river coldwater habitat below the upper two lakes up to an average of 2 percent over the 96-year simulation period (Figures 8-7 through 8-11). Increasing spring releases reduces storage levels in summer and fall sufficiently to reduce the amount of coldwater habitat retained over the summer and fall, and thus released to the river. The reduction occurs in drought and nondrought years. The effect is greater for lower permanent pools because the spring releases are retained longer through drought periods with lower permanent pools than higher permanent pools. Eliminating constraints on flood control for the spring releases further reduces coldwater river habitat, because the lakes are further drawn down. Although eliminating navigation in August and September increases long-term average coldwater habitat in the lakes (Section 7.3), lower releases from the lakes effectively balance out the benefit or even slightly reduce habitat.

8.4 PERMANENT POOL LEVEL

An increase in the permanent pool level increases total coldwater fish habitat in the river below the upper two mainstem lakes up to 5 percent (Figure 8-12).

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
ABAA10	187.4	143.5	43.9
ABAA11	184.2	142.0	42.3
ABAA20	193.9	147.5	46.4
AAAA21	191.9	146.0	45.9
AAAB21	191.9	146.0	45.9
AAAC21	191.9	146.0	45.9
AAAD21	191.9	146.0	45.9
AAAE21	191.9	146.0	45.9
AABB21	191.1	145.5	45.6
AABC21	191.1	145.5	45.6
AABD21	191.1	145.5	45.6
AABE21	191.1	145.4	45.7
AACC21	190.1	144.8	45.4
AACD21	190.1	144.8	45.4
AACE21	190.1	144.8	45.4
AADD21	190.2	144.9	45.4
AADE21	189.9	144.4	45.5
AAEE21	187.7	142.6	45.1
ABAA21	190.1	145.0	45.1
ABAB21	190.1	145.0	45.1
ABAC21	190.1	145.0	45.1
ABAD21	190.1	145.0	45.1
ABAE21	190.1	145.0	45.1
ABBB21	189.5	144.6	44.9
ABBC21	189.5	144.6	44.9
ABBD21	189.4	144.6	44.9
ABBE21	189.2	144.3	44.9
ABCC21	189.8	145.0	44.8
ABCD21	189.5	144.8	44.7
ABCE21	189.3	144.6	44.7
ABDD21	189.0	144.5	44.5
ABDE21	188.3	143.8	44.5
ACAA21	188.8	144.7	44.2
ACAB21	188.4	144.3	44.1
ACAC21	189.2	145.0	44.2
ACAD21	189.5	145.2	44.3
ACAE21	189.2	145.0	44.1

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
ACBB21	188.6	144.5	44.1
ACBC21	188.7	144.7	44.0
ACBD21	188.4	144.4	44.0
ACBE21	189.1	145.0	44.2
ACCC21	188.6	144.5	44.1
ACCD21	188.3	144.2	44.1
ACCE21	188.4	144.2	44.2
ACDD21	187.7	143.7	44.0
ACDE21	187.4	143.6	43.8
ADAA21	188.3	144.6	43.7
ADAB21	188.2	144.5	43.6
ADAC21	188.4	144.6	43.9
ADAD21	188.9	145.1	43.8
ADAE21	188.8	144.9	43.9
ADBB21	187.5	143.7	43.7
ADBC21	187.6	144.1	43.6
ADBD21	188.3	144.4	43.9
ADBE21	187.9	144.1	43.8
ADCC21	187.5	144.0	43.5
ADCD21	186.9	143.5	43.5
ADCE21	186.5	143.3	43.2
ADDD21	186.6	143.2	43.4
ADDE21	187.0	143.6	43.4
BAAA21	192.3	146.1	46.2
BAAB21	192.3	146.1	46.2
BAAC21	192.3	146.1	46.2
BAAD21	192.3	146.1	46.2
BAAE21	192.3	146.1	46.2
BABB21	191.9	145.7	46.2
BABC21	192.0	145.8	46.2
BABD21	191.9	145.7	46.1
BABE21	191.7	145.5	46.1
BACC21	191.4	145.4	46.0
BACD21	191.6	145.6	46.0
BACE21	191.5	145.6	45.9
BADD21	191.3	145.5	45.7
BADE21	190.7	144.7	45.9

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
BBAA21	191.5	145.8	45.6
BBAB21	191.8	145.9	45.9
BBAC21	191.5	145.7	45.8
BBAD21	191.5	145.8	45.8
BBAE21	191.5	145.9	45.6
BBBB21	191.2	145.6	45.6
BBBC21	191.3	145.7	45.6
BBBD21	191.2	145.6	45.5
BBBE21	191.2	145.5	45.8
BBCC21	190.4	145.1	45.3
BBCD21	190.5	145.2	45.3
BBCE21	190.4	145.1	45.4
BBDD21	190.1	144.7	45.4
BBDE21	189.7	144.5	45.2
BCAA21	190.3	145.6	44.7
BCAB21	190.1	145.6	44.6
BCAC21	189.9	145.3	44.6
BCAD21	190.1	145.3	44.8
BCAE21	190.2	145.4	44.8
BCBB21	190.2	145.5	44.7
BCBC21	190.2	145.3	44.9
BCBD21	189.8	145.2	44.6
BCBE21	189.9	145.3	44.6
BCCC21	190.3	145.1	45.2
BCCD21	189.8	144.9	44.9
BCCE21	190.6	145.2	45.3
BCDD21	189.3	144.5	44.7
BCDE21	189.6	144.6	45.0
BDAA21	190.0	145.6	44.4
BDAB21	189.0	144.9	44.1
BDAC21	189.3	145.2	44.1
BDAD21	189.5	145.0	44.5
BDAE21	189.3	145.0	44.3
BDBB21	189.6	145.2	44.4
BDBC21	189.1	144.8	44.3
BDBD21	189.5	145.0	44.5
BDBE21	189.2	145.0	44.3

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
BDCC21	188.7	144.6	44.1
BDCD21	188.4	144.5	43.9
BDCE21	189.2	144.9	44.3
BDDD21	188.1	144.1	44.0
CAAA21	192.5	146.3	46.2
CAAB21	192.4	146.2	46.2
CAAC21	192.4	146.1	46.3
CAAD21	192.6	146.3	46.3
CAAE21	192.5	146.2	46.3
CABB21	192.9	146.3	46.5
CABC21	192.7	146.1	46.6
CABD21	192.5	146.0	46.5
CABE21	192.5	146.0	46.5
CACC21	192.0	145.8	46.1
CACD21	192.3	146.1	46.2
CACE21	191.9	145.7	46.2
CADD21	191.8	145.9	45.9
CADE21	191.7	145.5	46.2
CBAA21	192.0	146.1	45.8
CBAB21	192.2	146.2	46.1
CBAC21	192.1	146.2	45.9
CBAD21	192.0	146.0	46.0
CBAE21	191.7	146.0	45.7
CBBB21	191.8	146.1	45.7
CBBC21	191.6	145.9	45.7
CBBD21	191.8	146.0	45.9
CBBE21	192.0	146.0	46.0
CBCC21	191.5	145.9	45.7
CBCD21	191.2	145.8	45.4
CBCE21	191.7	145.7	46.1
CBDD21	191.7	145.8	45.9
CBDE21	190.9	145.2	45.7
CCAA21	190.7	145.8	44.9
CCAB21	190.2	145.5	44.7
CCAC21	190.1	145.5	44.6
CCAD21	190.5	145.8	44.6
CCAE21	190.7	145.6	45.1

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
CCBB21	190.5	145.7	44.8
CCBC21	190.5	145.6	44.9
CCBD21	190.0	145.4	44.6
CCBE21	190.9	145.7	45.2
CCCC21	191.0	146.0	45.1
CCCD21	191.5	146.3	45.3
CCCE21	190.8	145.4	45.4
CCDD21	190.8	145.3	45.5
CDAA21	190.3	146.0	44.3
CDAB21	190.0	145.9	44.2
CDAC21	189.9	145.8	44.1
CDAD21	190.8	146.2	44.6
CDAE21	191.0	146.2	44.7
CDBB21	190.1	145.7	44.4
CDBC21	190.5	146.0	44.5
CDBD21	191.0	146.4	44.7
CDBE21	191.0	146.0	44.9
CDCC21	190.1	145.6	44.5
CDCD21	190.6	145.5	45.1
CDDD21	189.6	145.0	44.6
DAAA21	193.4	146.5	46.9
DAAB21	193.6	146.6	47.0
DAAC21	193.6	146.5	47.1
DAAD21	193.5	146.5	47.0
DAAE21	193.5	146.6	47.0
DABB21	193.5	146.7	46.8
DABC21	193.3	146.6	46.7
DABD21	194.4	147.0	47.4
DABE21	193.6	146.4	47.2
DACC21	193.8	146.7	47.1
DACD21	193.9	146.7	47.1
DACE21	193.7	146.3	47.4
DADD21	193.8	146.4	47.3
DBAA21	194.2	146.8	47.5
DBAB21	194.1	146.7	47.3
DBAC21	194.0	146.7	47.3
DBAD21	193.9	146.7	47.1

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
DBAE21	193.4	146.4	47.0
DBBB21	193.5	146.5	47.0
DBBC21	193.6	146.6	47.1
DBBD21	193.5	146.4	47.1
DBBE21	194.0	146.6	47.4
DBCC21	192.9	146.1	46.8
DBCD21	193.6	146.3	47.3
DBDD21	193.5	146.1	47.4
DCAA21	193.5	146.5	46.9
DCAB21	192.9	146.5	46.5
DCAC21	192.9	146.5	46.5
DCAD21	193.0	146.3	46.6
DCAE21	193.7	146.7	47.0
DCBB21	192.8	146.5	46.3
DCBC21	192.6	146.4	46.2
DCBD21	192.2	146.3	45.8
DCBE21	194.4	146.9	47.6
DCCC21	192.5	146.2	46.4
DCCD21	193.4	146.4	47.0
DCDD21	194.7	146.9	47.8
DDAA21	192.1	146.4	45.7
DDAB21	193.5	146.9	46.6
DDAC21	192.5	146.4	46.0
DDAD21	192.2	146.3	46.0
DDAE21	194.8	147.4	47.4
DDBB21	191.8	146.3	45.5
DDBC21	192.1	146.3	45.8
DDBD21	192.8	146.2	46.5
DDCC21	192.2	145.9	46.3
DDCD21	195.0	147.3	47.7
EAAA21	196.7	148.1	48.6
EAAB21	196.2	148.0	48.2
EAAC21	196.0	148.0	48.0
EAAD21	195.9	147.9	48.0
EAAE21	195.8	147.9	47.9
EABB21	196.2	148.1	48.0
EABC21	196.1	148.0	48.1

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
EABD21	196.2	148.1	48.1
EABE21	195.7	147.7	48.0
EACC21	195.7	147.8	47.9
EACD21	195.6	147.7	47.9
EADD21	195.1	147.4	47.7
EBAA21	196.0	147.8	48.1
EBAB21	195.7	147.9	47.7
EBAC21	196.3	147.9	48.4
EBAD21	195.5	147.8	47.7
EBAE21	195.2	147.4	47.8
EBBB21	196.6	148.1	48.5
EBBC21	196.1	148.1	48.0
EBBD21	195.4	147.7	47.6
EBCC21	195.6	147.5	48.1
EBCD21	195.0	147.4	47.6
ECAA21	196.3	147.9	48.4
ECAB21	196.1	147.9	48.2
ECAC21	195.8	147.8	48.0
ECAD21	195.3	147.4	47.8
ECBB21	195.9	147.9	48.0
ECBC21	195.5	147.6	47.9
ECBD21	194.9	147.4	47.4
ECCC21	197.2	148.1	49.1
ECCD21	197.0	148.0	49.0
EDAA21	197.4	148.1	49.3
EDAB21	197.2	147.9	49.3
EDAC21	196.8	148.0	48.8
EDBB21	196.7	147.8	48.9
EDBC21	196.6	148.3	48.4
EDBD21	196.6	147.9	48.7
EDCC21	196.4	147.9	48.6
GAAA21	199.4	149.4	50.0
GAAB21	199.7	149.7	49.9
GAAC21	199.8	149.7	50.0
GAAD21	198.4	149.6	48.8
GAAE21	198.3	149.7	48.6
GABB21	200.0	149.2	50.8

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
GABC21	200.2	149.3	50.8
GABD21	199.6	149.3	50.3
GACC21	199.7	149.2	50.5
GACD21	199.3	149.1	50.3
GBAA21	199.6	149.2	50.5
GBAB21	199.9	149.3	50.6
GBAC21	200.0	149.4	50.6
GBAD21	199.4	149.3	50.1
GBBB21	200.6	149.4	51.2
GBBC21	199.7	149.4	50.3
GBBD21	199.2	149.2	50.0
GBCC21	199.8	149.3	50.5
GCAA21	201.0	149.5	51.5
GCAB21	200.8	149.4	51.3
GCAC21	200.3	149.4	50.9
GCAD21	199.7	149.3	50.4
GCBB21	200.4	149.4	51.0
GDAA21	200.6	149.5	51.1
ABAE31	187.8	145.0	42.8
BBAE31	188.7	145.5	43.2
CBAE31	189.5	146.0	43.5
DBAE31	190.9	146.7	44.2
EBAE31	192.7	147.1	45.5
ABAE32	186.1	144.8	41.4
BBAE32	187.3	145.4	41.9
CBAE32	188.2	146.1	42.1
DBAE32	189.7	146.7	43.1
EBAE32	191.7	147.4	44.3
ABAE33	183.4	144.5	39.0
BBAE33	184.8	145.3	39.6
CBAE33	185.5	145.6	39.8
DBAE33	187.2	146.2	41.0
EBAE33	190.8	147.3	43.5
ABAE41	186.0	144.3	41.7
BBAE41	186.8	144.8	42.0
CBAE41	187.6	145.4	42.2
DBAE41	189.2	146.0	43.2

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
EBAE41	191.1	146.7	44.4
ABAE42	184.9	144.9	39.9
BBAE42	186.1	145.7	40.5
CBAE42	187.0	146.2	40.8
DBAE42	188.9	146.9	42.1
EBAE42	190.4	147.3	43.1
ABAE43	182.6	144.2	38.4
BBAE43	184.1	145.0	39.1
CBAE43	185.2	145.6	39.6
DBAE43	186.9	146.3	40.5
EBAE43	191.0	148.1	42.9
ABAE51	185.7	144.5	41.1
BBAE51	186.4	145.1	41.4
CBAE51	187.2	145.5	41.7
DBAE51	189.0	146.1	42.9
EBAE51	190.3	146.7	43.7
ABAE52	184.8	145.5	39.3
BBAE52	185.9	146.3	39.6
CBAE52	186.5	146.3	40.2
DBAE52	189.2	147.6	41.6
EBAE52	189.8	148.2	41.6
ABAE53	182.9	145.0	37.9
BBAE53	184.5	145.9	38.5
CBAE53	184.7	146.1	38.7
DBAE53	186.4	146.6	39.9
EBAE53	188.4	147.3	41.2
ABAE61	186.8	143.7	43.1
BBAE61	187.2	143.7	43.5
CBAE61	188.0	144.3	43.7
DBAE61	190.4	145.0	45.3
EBAE61	192.5	146.0	46.5
ABAE62	184.0	143.5	40.4
BBAE62	184.2	143.7	40.6
CBAE62	186.6	145.2	41.3
DBAE62	187.4	144.8	42.6
EBAE62	192.9	147.0	45.9
ABAE63	182.1	143.5	38.7

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
BBAE63	182.8	143.7	39.2
CBAE63	184.9	145.4	39.5
DBAE63	185.1	145.3	39.8
EBAE63	190.7	147.3	43.4
ABAE71	187.5	145.0	42.5
BBAE71	188.4	145.6	42.8
CBAE71	189.0	146.0	43.0
DBAE71	191.0	146.7	44.3
EBAE71	192.3	147.3	45.0
ABAE72	185.4	145.4	40.0
BBAE72	186.3	145.9	40.3
CBAE72	187.0	146.3	40.7
DBAE72	188.4	146.9	41.5
EBAE72	190.7	147.7	43.0
ABAE73	183.6	145.1	38.5
BBAE73	184.7	145.6	39.0
CBAE73	185.3	146.2	39.0
DBAE73	187.0	146.6	40.4
EBAE73	188.5	147.6	40.9
ABAE81	186.5	144.0	42.6
BBAE81	187.0	143.9	43.0
CBAE81	187.7	144.6	43.2
DBAE81	190.2	145.3	44.9
EBAE81	195.1	145.8	49.3
ABAE82	184.1	144.2	39.9
BBAE82	184.8	144.6	40.2
CBAE82	187.0	146.0	41.0
DBAE82	186.9	145.4	41.5
EBAE82	192.8	145.5	47.3
ABAE83	181.8	143.8	38.0
BBAE83	183.7	144.6	39.1
CBAE83	184.3	145.7	38.6
DBAE83	185.9	146.3	39.6
EBAE83	189.5	143.8	45.7
ABAE91	186.9	145.1	41.8
BBAE91	187.8	145.8	42.1
CBAE91	188.5	146.2	42.3

Table 8-1. Average annual coldwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam
DBAE91	190.4	146.9	43.5
EBAE91	192.0	147.5	44.5
ABAE92	184.9	146.0	38.9
BBAE92	185.7	146.5	39.2
CBAE92	186.2	146.8	39.4
DBAE92	187.9	147.4	40.5
EBAE92	190.5	148.4	42.1
ABAE93	183.6	145.6	37.9
BBAE93	184.2	145.9	38.3
CBAE93	185.4	146.6	38.9
DBAE93	186.3	147.0	39.3
EBAE93	191.2	148.9	42.3
EVQ2XX	177.0	135.6	41.4

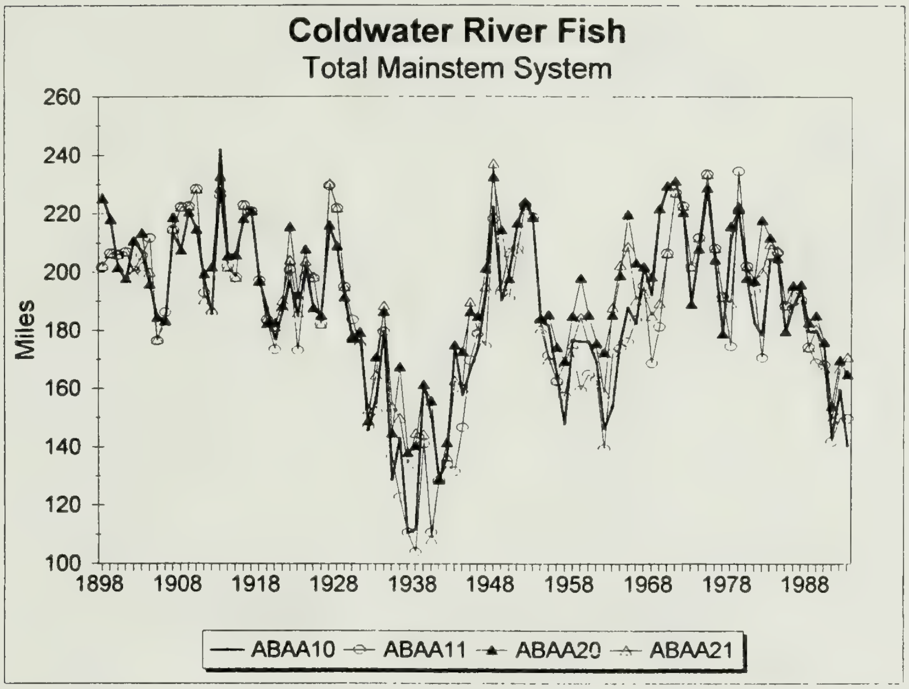

Figure 8-1. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

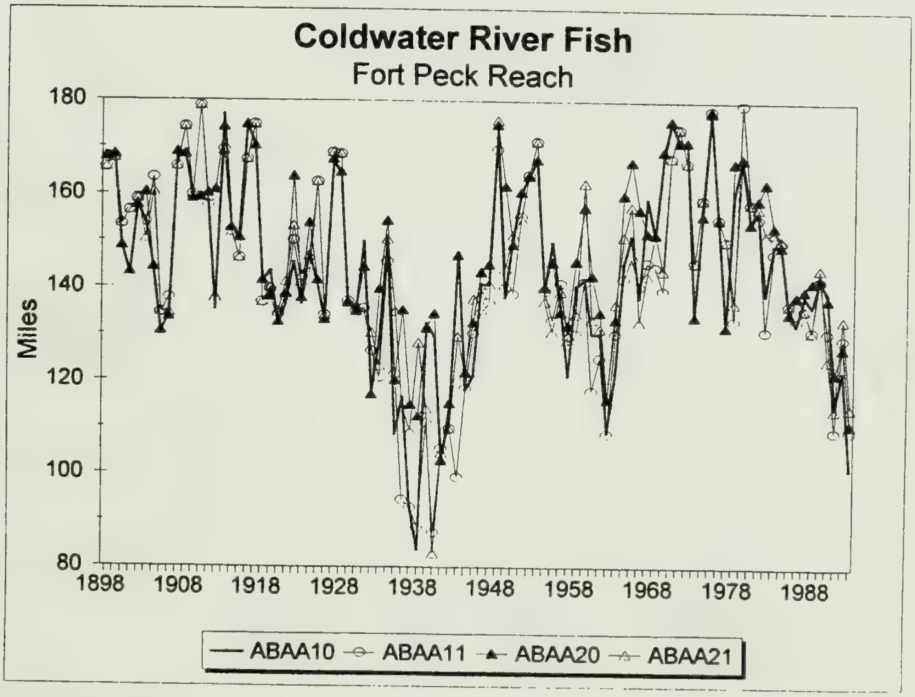

Figure 8-2. Annual average miles of coldwater fish habitat below Fort Peck Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

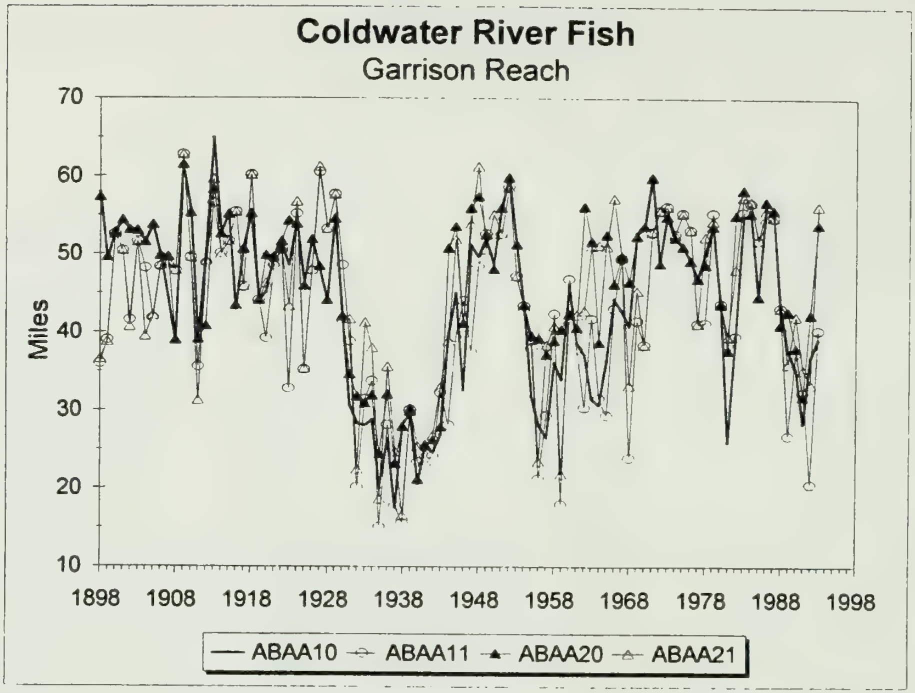

Figure 8-3. Annual average miles of coldwater fish habitat below Garrison Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

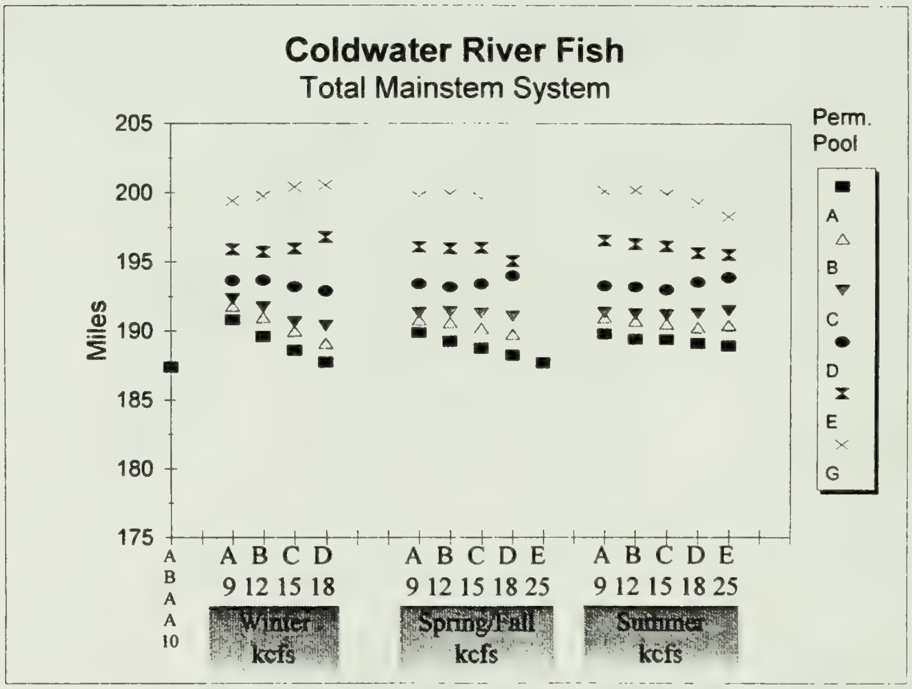

Figure 8-4. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period by nonnavigation service level.

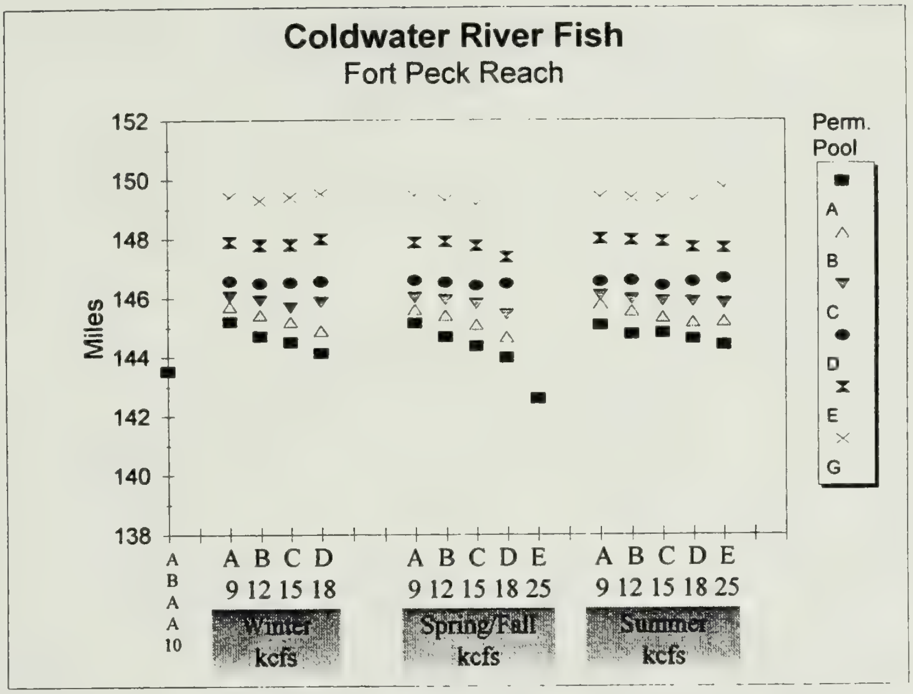

Figure 8-5. Annual average miles of coldwater fish habitat below Fort Peck Dam over the 96-year simulation period by nonnavigation service level.

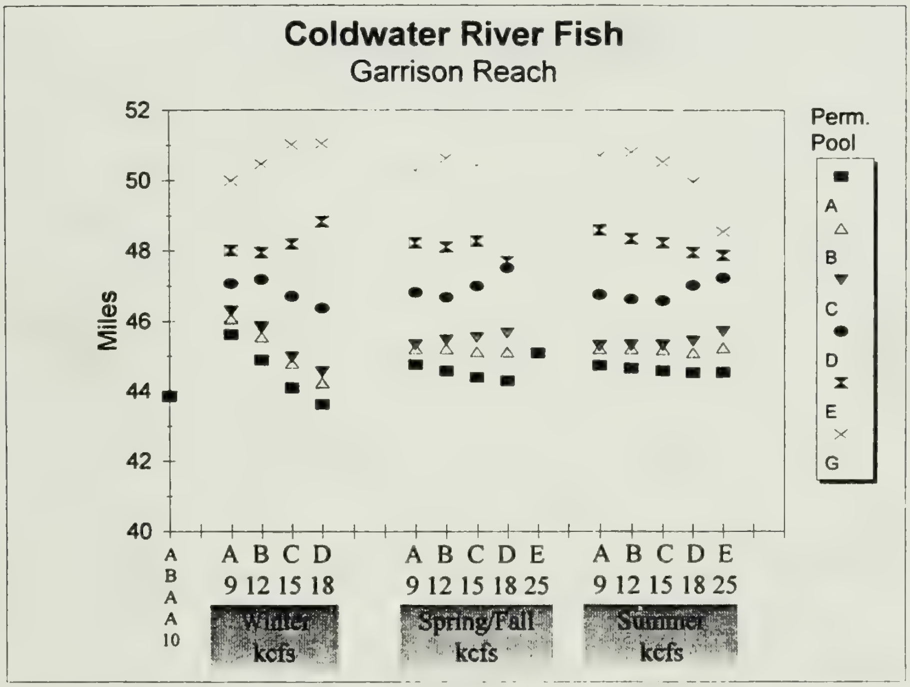

Figure 8-6. Annual average miles of coldwater fish habitat below Garrison Dam over the 96-year simulation period by nonnavigation service level.

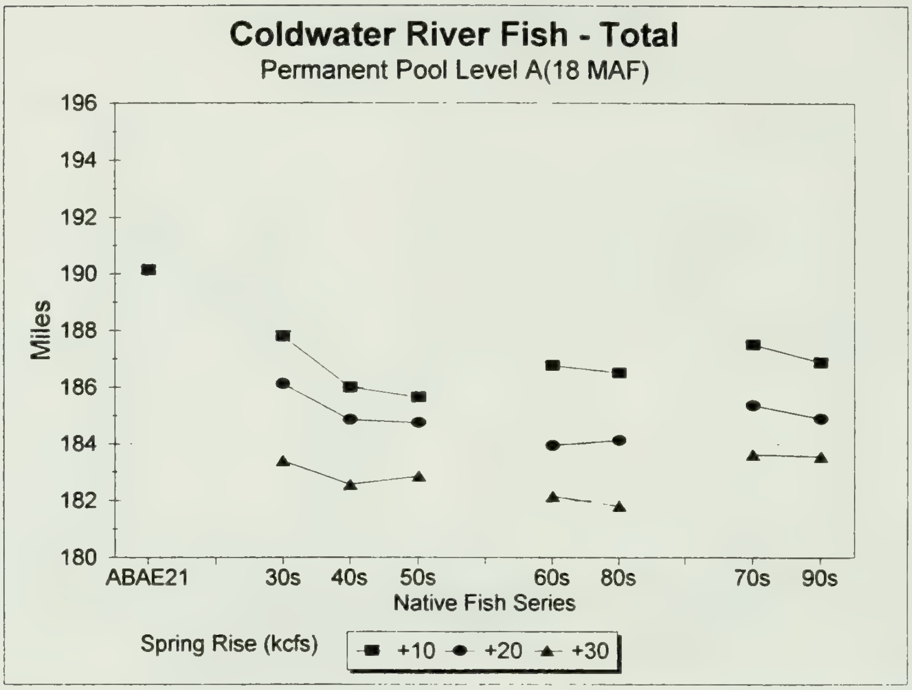

Figure 8-7. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

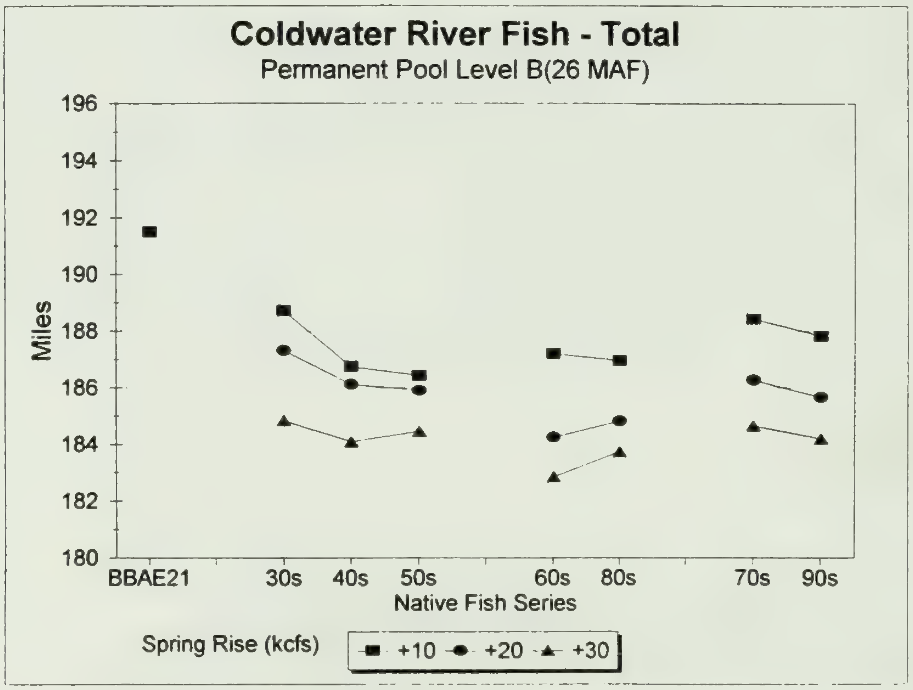

Figure 8-8. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

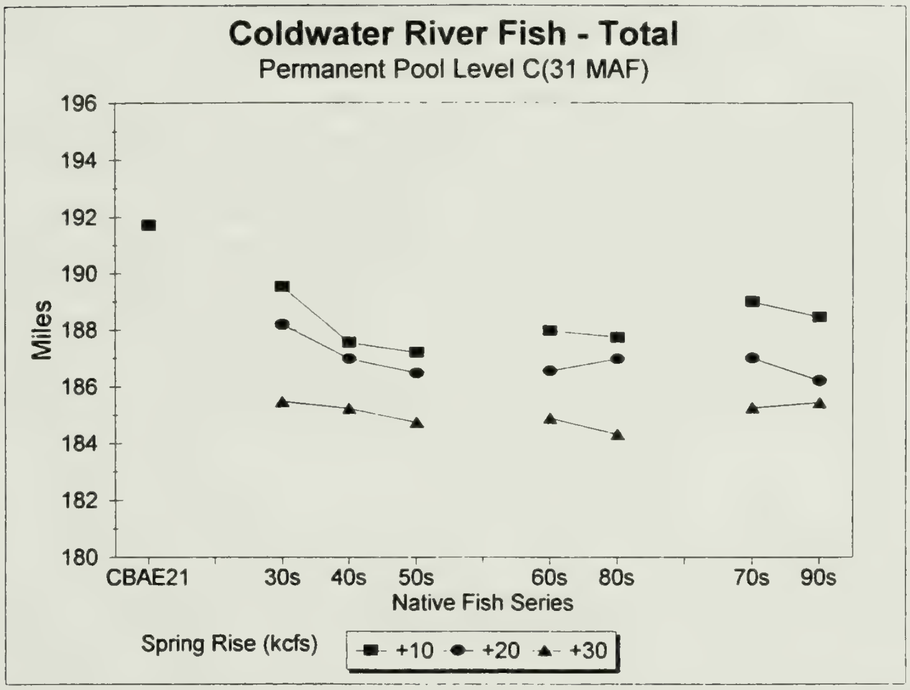

Figure 8-9. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

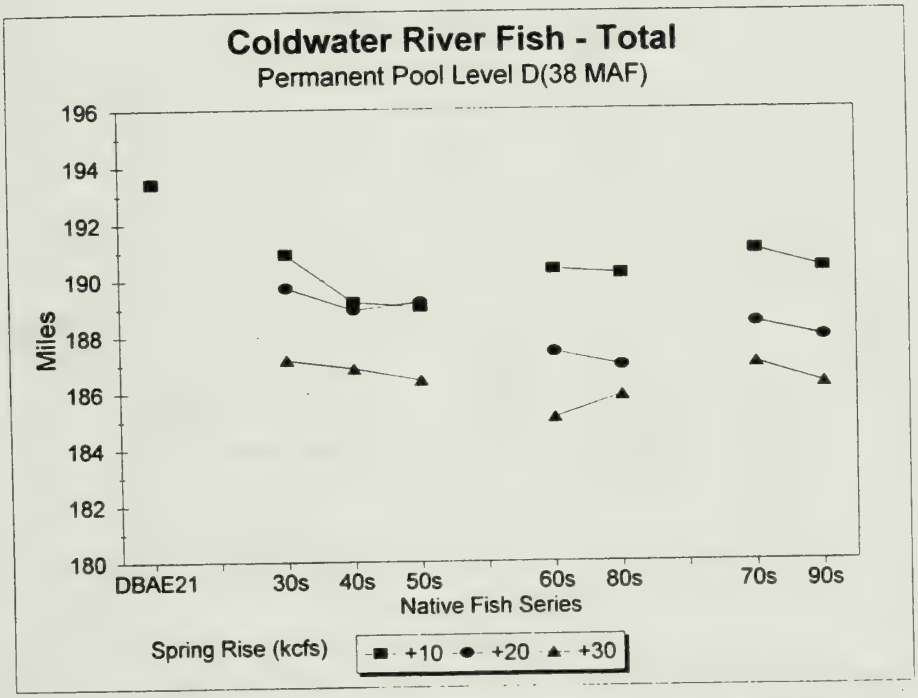

Figure 8-10. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

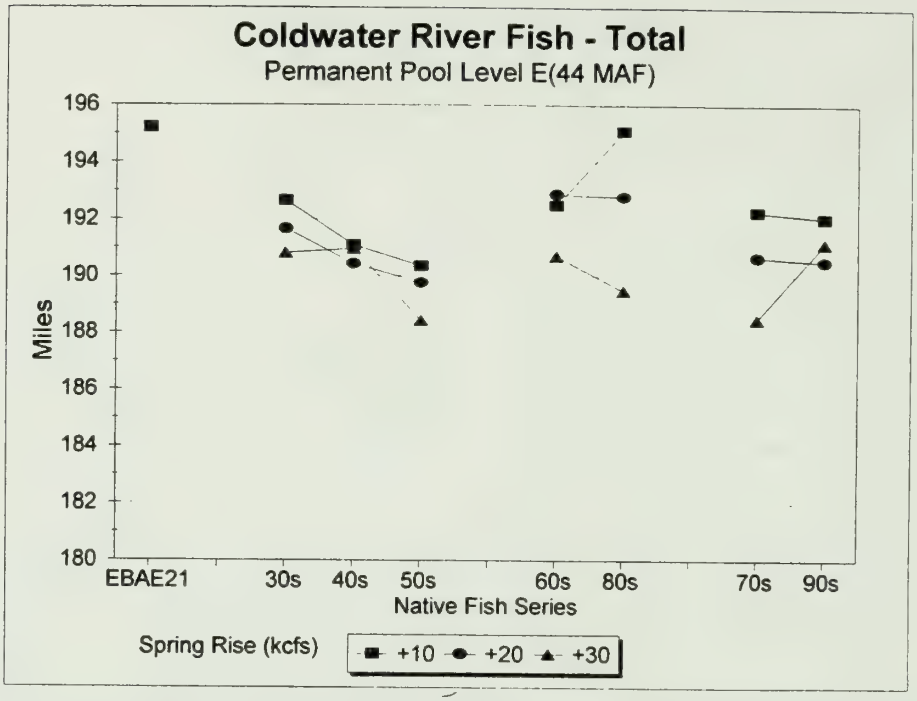

Figure 8-11. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

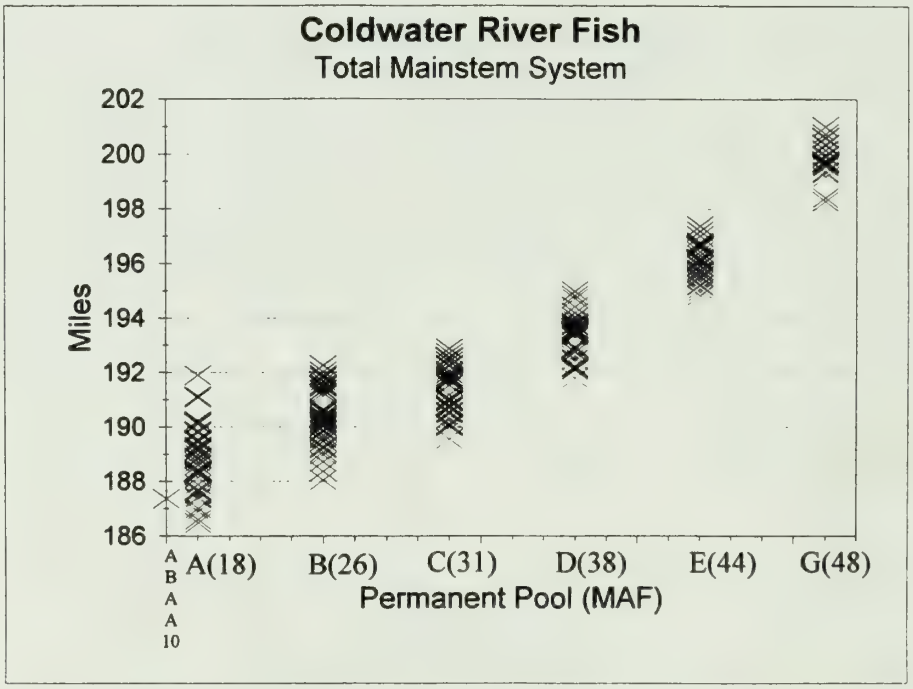

Figure 8-12. Annual average miles of coldwater fish habitat below two upper mainstem lakes over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

9.0 RIVER WARMWATER FISH HABITAT

The number of miles of warmwater fish habitat in the Missouri River below Fort Peck Dam, Garrison Dam, and Fort Randall Dam was estimated for the 96-year simulation period for all alternatives (see Table 9-1 at the end of the narrative section). The temperature regression model used for coldwater river habitat was also used to estimate warmwater fish habitat below the dams (Corps, 1994e). The average number of miles of warmwater habitat for each month of the year from spring through fall was also estimated by the model.

9.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

9.1.1 Total System

The modified navigation and intrasystem regulation criteria would have a mixed effect on total warmwater fish habitat in the Missouri River below the three mainstem lakes. The higher lake levels associated with the modified navigation criteria in drought periods lead to slightly (2 miles or about 4 percent) lower average number of miles of warmwater fish habitat over the 96-year simulation period (Table 9-2). As Figure 9-1 shows, the difference occurs in drought periods (1930s, late 1950s, and late 1980s). Modified intrasystem regulation increases the number of miles slightly (1 to 2 percent), with the increase occurring sporadically over the 96-year simulation period.

Table 9-2. Average annual number of miles of warmwater fish habitat below the mainstem lakes over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total Index	Below Fort Peck Dam	Below Garrison Dam	Below Fort Randall Dam
Current	Current	ABAA10	49.4	28.7	8.2	12.5
Modified	Current	ABAA20	47.2	25.9	7.2	14.1
Current	Modified	ABAA11	50.9	28.6	9.2	13.0
Modified	Modified	ABAA21	49.0	26.0	8.4	14.5

9.1.2 Missouri River Below Fort Peck Dam

Below Fort Peck Dam, the number of miles of warmwater habitat is lower under the modified navigation criteria (Table 9-2; Figure 9-2), because lake levels are higher and releases colder especially during and following the droughts of the 1930s, late 1950s, and late 1980s. There is little difference in warmwater river habitat with modified intrasystem regulation (Table 9-2; Figure 9-2).

9.1.3 Missouri River Below Garrison Dam

As below Fort Peck Dam, the average number miles of warmwater habitat decreases below Garrison Dam with the modified navigation criteria (Table 9-2; Figure 9-3). Again, the difference occurs primarily during and following drought periods. Modified intrasystem regulation leads to sporadically sharply higher (10 to 20 miles) average number of miles of warmwater habitat per year. In years when Lake Sakakawea is filling and releases are reduced, less miles below Garrison Dam would be influenced by coldwater releases and the river would also tend to warm more under lower flows from spring through fall.

9.1.4 Missouri River Below Fort Randall Dam

Contrary to the other two reaches, the modified navigation criteria increase the miles of warmwater river fish habitat below Fort Randall Dam (Table 9-2; Figure 9-4). Lower releases from Fort Randall Dam in drought periods because of reduced navigation releases increase the extent of warming in this river reach. Modified intrasystem regulation has little effect on the extent of warmwater habitat below Fort Randall Dam.

9.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

9.2.1 Total System

Total warmwater fish habitat in the Missouri River below the three mainstem lakes increases slightly with higher minimum nonnavigation service levels at lower permanent pools, and decreases slightly with higher minimum nonnavigation service levels at higher permanent pools (Figure 9-5). At lower permanent pools, higher minimum nonnavigation service levels affect warmwater habitat by reducing coldwater storage in the lakes in drought periods. At higher permanent pools, warmwater habitat declines with higher minimum nonnavigation service levels because more coldwater is released from the lakes.

9.2.2 Missouri River Below Fort Peck Dam

At lower permanent pools, higher minimum nonnavigation service levels affect warmwater habitat by reducing coldwater storage in the lakes in drought periods (Figure 9-6).

9.2.3 Missouri River Below Garrison Dam

At lower permanent pools, higher winter minimum nonnavigation service levels affect warmwater habitat by reducing spring through fall coldwater storage in the lakes in drought periods (Figure 9-7). Higher spring through fall minimum nonnavigation service levels tend to reduce warmwater habitat, because of increased releases of cold water from Lake Sakakawea during drought periods.

9.2.4 Missouri River Below Fort Randall Dam

Higher minimum nonnavigation service levels decrease the miles of warmwater habitat below Fort Randall Dam (Figure 9-8). Higher nonnavigation period releases increase the influence of coldwater releases and reduce the extent of warming on this reach of the river.

9.3 EFFECT OF NATIVE FISH SERIES

Increasing spring releases from storage would increase total warmwater fish habitat in the Missouri River below the three lakes up to more than 20 percent (over 10 miles) over the 96-year simulation period (Figures 9-9 through 9-13). Increasing spring releases reduces storage levels in summer and fall sufficiently to reduce the amount of coldwater habitat retained over the summer and fall, and thus released to the river. Increasing spring releases also reduces the need for summer and fall evacuation of cold lake water for flood control. Eliminating constraints on flood control for the spring releases has a slight negative effect on the extent of warmwater habitat (Figures 9-9 through 9-13), because higher releases increase the extent of effects of coldwater releases from the dams. Eliminating navigation in August and September has little effect on warmwater habitat (Figures 9-9 through 9-13) despite lower releases in summer. In nondrought years, lower summer flows do increase warmwater habitat; however, in drought years, the opposite is true.

9.4 PERMANENT POOL LEVEL

An increase in the permanent pool level decreases total warmwater fish habitat in the river below the three mainstem lakes up to 10 to 15 percent (Figure 9-14). Greater retention of cold water in the lakes overrides the opposing effect of lower summer through fall river flows associated with more frequent nonnavigation minimum flows for the higher permanent pool alternatives.

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
ABAA10	49.4	28.7	8.2	12.5
ABAA11	50.9	28.6	9.2	13.0
ABAA20	47.2	25.9	7.2	14.1
AAAA21	47.4	25.1	8.1	14.3
AAAB21	47.4	25.1	8.1	14.3
AAAC21	47.4	25.1	8.1	14.3
AAAD21	47.4	25.1	8.1	14.3
AAAE21	47.4	25.1	8.1	14.3
AABB21	48.1	25.5	8.2	14.4
AABC21	48.1	25.5	8.2	14.4
AABD21	48.1	25.5	8.2	14.4
AABE21	48.1	25.6	8.2	14.4
AACC21	49.3	26.5	8.3	14.5
AACD21	49.3	26.5	8.3	14.5
AACE21	49.3	26.5	8.3	14.5
AADD21	48.5	26.2	8.0	14.2
AADE21	49.0	26.7	8.2	14.1
AAEE21	49.9	29.2	7.8	12.8
ABAA21	49.0	26.0	8.4	14.5
ABAB21	49.0	26.0	8.4	14.5
ABAC21	49.0	26.0	8.4	14.5
ABAD21	49.0	26.0	8.4	14.5
ABAE21	49.0	26.0	8.4	14.5
ABBB21	49.3	26.4	8.4	14.5
ABBC21	49.3	26.4	8.4	14.5
ABBD21	49.3	26.4	8.4	14.5
ABBE21	49.8	26.9	8.5	14.4
ABCC21	48.9	26.2	8.4	14.3
ABCD21	49.3	26.6	8.6	14.2
ABCE21	49.2	26.7	8.5	14.1
ABDD21	48.8	26.7	8.2	13.9
ABDE21	49.7	27.6	8.4	13.7
ACAA21	49.7	26.4	8.8	14.4
ACAB21	50.0	26.8	8.8	14.4
ACAC21	49.2	26.2	8.7	14.3
ACAD21	49.2	26.0	8.9	14.3
ACAE21	49.6	26.4	9.0	14.2

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
ACBB21	49.7	26.5	8.9	14.2
ACBC21	49.8	26.5	9.1	14.2
ACBD21	50.2	27.1	8.9	14.2
ACBE21	49.1	26.4	8.8	13.9
ACCC21	50.1	26.9	9.0	14.1
ACCD21	50.4	27.3	8.9	14.1
ACCE21	49.5	27.2	8.6	13.6
ACDD21	49.9	27.5	8.7	13.8
ACDE21	50.5	28.1	9.0	13.4
ADAA21	50.4	26.9	9.1	14.3
ADAB21	50.5	27.0	9.2	14.3
ADAC21	49.9	26.6	9.1	14.2
ADAD21	49.8	26.3	9.3	14.1
ADAE21	49.4	26.5	9.0	13.9
ADBB21	50.8	27.4	9.2	14.3
ADBC21	50.9	27.2	9.4	14.3
ADBD21	49.3	26.6	8.9	13.9
ADBE21	50.0	27.2	9.0	13.8
ADCC21	50.2	27.1	9.3	13.9
ADCD21	50.8	27.8	9.1	13.9
ADCE21	50.7	27.9	9.3	13.5
ADDD21	50.7	28.1	9.0	13.6
ADDE21	49.4	27.9	8.6	13.0
BAAA21	47.8	25.3	8.1	14.4
BAAB21	47.8	25.3	8.1	14.4
BAAC21	47.8	25.3	8.1	14.4
BAAD21	47.8	25.3	8.1	14.4
BAAE21	47.8	25.3	8.1	14.4
BABB21	47.7	25.6	7.7	14.4
BABC21	47.7	25.6	7.7	14.4
BABD21	47.9	25.7	7.8	14.4
BABE21	47.7	25.8	7.7	14.2
BACC21	47.8	25.7	7.8	14.3
BACD21	47.8	25.7	7.8	14.2
BACE21	47.7	25.8	7.9	14.0
BADD21	47.8	25.8	7.9	14.1
BADE21	48.1	26.9	7.7	13.5

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
BBAA21	48.2	25.6	8.2	14.4
BBAB21	47.3	25.3	7.7	14.2
BBAC21	47.6	25.4	7.8	14.3
BBAD21	47.5	25.3	7.9	14.2
BBAE21	48.0	25.6	8.1	14.2
BBBB21	47.8	25.5	8.0	14.2
BBBC21	48.1	25.7	8.1	14.3
BBBD21	48.3	25.8	8.2	14.3
BBBE21	47.4	25.8	7.9	13.7
BBCC21	48.2	26.2	8.1	13.9
BBCD21	48.0	26.3	7.9	13.8
BBCE21	48.0	26.5	8.0	13.5
BBDD21	48.0	26.7	7.9	13.5
BBDE21	48.7	27.5	8.0	13.2
BCAA21	48.8	25.9	8.6	14.3
BCAB21	49.2	26.1	8.8	14.3
BCAC21	49.7	26.5	8.8	14.3
BCAD21	48.6	26.1	8.5	14.1
BCAE21	48.2	26.1	8.3	13.8
BCBB21	48.9	26.3	8.6	14.1
BCBC21	48.2	26.1	8.3	13.9
BCBD21	48.7	26.3	8.6	13.8
BCBE21	48.5	26.3	8.6	13.5
BCCC21	48.2	26.4	8.3	13.6
BCCD21	48.3	26.6	8.2	13.4
BCCE21	47.5	26.9	7.9	12.8
BCDD21	49.2	27.1	8.6	13.5
BCDE21	48.0	27.5	7.8	12.7
BDAA21	50.0	27.0	8.7	14.3
BDAB21	49.2	26.3	8.8	14.1
BDAC21	49.2	26.2	8.9	14.1
BDAD21	48.4	26.1	8.5	13.8
BDAE21	49.0	26.6	8.7	13.6
BDBB21	48.7	26.3	8.4	13.9
BDBC21	48.9	26.4	8.7	13.9
BDBD21	48.5	26.4	8.4	13.7
BDBE21	48.3	26.8	8.3	13.2

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
BDCC21	48.7	26.6	8.5	13.6
BDCD21	49.3	26.8	8.8	13.6
BDCE21	47.7	26.9	8.1	12.8
BDDD21	49.1	27.5	8.4	13.2
CAAA21	47.3	25.2	7.8	14.3
CAAB21	47.5	25.4	7.8	14.3
CAAC21	47.5	25.4	7.7	14.3
CAAD21	47.3	25.2	7.7	14.3
CAAE21	47.0	25.2	7.6	14.2
CABB21	46.9	25.5	7.3	14.1
CABC21	46.9	25.5	7.3	14.1
CABD21	47.0	25.6	7.4	14.1
CABE21	46.9	25.6	7.4	13.8
CACC21	47.2	25.7	7.4	14.1
CACD21	46.7	25.4	7.4	13.8
CACE21	47.0	26.0	7.5	13.5
CADD21	47.0	25.9	7.5	13.6
CADE21	46.6	26.6	7.1	12.9
CBAA21	47.4	25.5	7.7	14.2
CBAB21	47.0	25.5	7.5	14.1
CBAC21	47.0	25.3	7.7	14.1
CBAD21	47.3	25.6	7.7	14.1
CBAE21	47.2	25.7	7.7	13.8
CBBB21	47.3	25.4	7.8	14.0
CBBC21	47.5	25.7	7.8	13.9
CBBD21	47.0	25.5	7.7	13.8
CBBE21	46.6	25.7	7.6	13.3
CBCC21	47.0	25.7	7.7	13.6
CBCD21	47.2	25.9	7.8	13.6
CBCE21	46.7	26.5	7.3	12.9
CBDD21	46.8	26.4	7.4	13.1
CBDE21	46.7	26.9	7.3	12.6
CCAA21	48.1	25.5	8.4	14.1
CCAB21	48.4	25.9	8.4	14.1
CCAC21	48.7	26.1	8.5	14.1
CCAD21	48.2	25.7	8.5	14.0
CCAE21	47.6	26.1	8.0	13.6

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
CCBB21	47.9	25.8	8.2	13.9
CCBC21	48.0	25.9	8.3	13.8
CCBD21	48.3	26.2	8.4	13.7
CCBE21	47.2	26.5	7.9	12.9
CCCC21	47.6	26.1	8.0	13.6
CCCD21	47.2	26.2	7.7	13.3
CCCE21	46.8	26.9	7.3	12.7
CCDD21	46.9	26.7	7.2	13.0
CDAA21	48.3	25.8	8.5	14.1
CDAB21	48.4	25.8	8.5	14.1
CDAC21	48.3	26.0	8.4	13.9
CDAD21	47.8	25.9	8.2	13.6
CDAE21	47.1	26.0	7.8	13.3
CDBB21	48.4	25.9	8.7	13.8
CDBC21	48.0	26.0	8.3	13.6
CDBD21	47.2	26.0	7.9	13.4
CDBE21	46.3	26.1	7.4	12.8
CDCC21	48.1	26.6	8.0	13.5
CDCD21	47.2	26.6	7.6	13.0
CDDD21	47.0	26.5	7.7	12.8
DAAA21	46.9	25.0	7.6	14.3
DAAB21	46.7	25.2	7.2	14.2
DAAC21	46.5	25.2	7.2	14.1
DAAD21	46.6	25.0	7.5	14.2
DAAE21	46.4	25.3	7.3	13.9
DABB21	46.8	25.1	7.7	14.0
DABC21	46.5	24.9	7.6	14.1
DABD21	47.8	26.9	6.6	14.3
DABE21	45.9	25.6	7.2	13.1
DACC21	45.3	24.9	7.3	13.1
DACD21	45.7	25.3	7.2	13.2
DACE21	44.9	25.5	6.9	12.5
DADD21	45.4	25.3	7.3	12.8
DBAA21	45.7	25.1	7.2	13.3
DBAB21	45.6	25.1	7.1	13.5
DBAC21	45.8	25.2	7.0	13.5
DBAD21	45.4	25.1	7.1	13.1

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
DBAE21	46.1	25.7	7.2	13.3
DBBB21	45.8	25.4	7.0	13.4
DBBC21	45.5	25.3	7.1	13.1
DBBD21	45.8	25.5	7.2	13.1
DBBE21	44.6	25.1	7.1	12.5
DBCC21	46.4	25.7	7.3	13.3
DBCD21	45.4	25.2	7.3	12.9
DBDD21	45.0	25.3	7.0	12.7
DCAA21	46.5	25.6	7.1	13.8
DCAB21	46.5	25.6	7.2	13.8
DCAC21	46.3	25.5	7.2	13.6
DCAD21	46.6	25.8	7.3	13.5
DCAE21	44.9	24.8	7.2	12.9
DCBB21	46.9	25.6	7.6	13.6
DCBC21	46.9	25.7	7.6	13.6
DCBD21	46.9	25.9	7.5	13.5
DCBE21	43.6	25.1	6.3	12.2
DCCC21	46.1	25.5	7.4	13.2
DCCD21	45.3	25.3	7.3	12.8
DCDD21	43.5	25.0	6.3	12.2
DDAA21	46.9	25.3	7.8	13.7
DDAB21	46.0	25.0	7.5	13.5
DDAC21	46.5	25.5	7.5	13.5
DDAD21	46.5	25.5	7.5	13.5
DDAE21	43.4	24.6	6.4	12.3
DDBB21	47.0	25.4	8.0	13.6
DDBC21	46.6	25.5	7.6	13.5
DDBD21	45.7	25.2	7.4	13.1
DDCC21	46.1	25.5	7.6	13.0
DDCD21	43.0	24.4	6.4	12.1
EAAA21	44.5	24.0	7.1	13.4
EAAB21	44.7	24.1	7.3	13.3
EAAC21	44.9	24.1	7.4	13.4
EAAD21	44.8	24.2	7.2	13.4
EAAE21	45.0	24.3	7.1	13.6
EABB21	44.8	24.1	7.5	13.3
EABC21	44.6	24.2	7.1	13.3

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
EABD21	44.3	24.1	7.1	13.1
EABE21	44.2	24.3	7.1	12.8
EACC21	44.5	24.2	6.8	13.4
EACD21	45.1	24.4	7.0	13.7
EADD21	44.6	24.6	7.0	13.1
EBAA21	44.8	24.2	7.2	13.4
EBAB21	45.0	24.2	7.4	13.4
EBAC21	44.0	23.7	7.0	13.3
EBAD21	44.9	24.3	7.1	13.5
EBAE21	44.5	24.4	7.1	13.0
EBBB21	43.8	23.7	7.0	13.1
EBBC21	43.8	23.8	7.1	13.0
EBBD21	44.9	24.2	7.2	13.5
EBCC21	44.1	24.1	7.1	12.9
EBCD21	44.7	24.3	7.2	13.1
ECAA21	44.4	24.0	7.3	13.2
ECAB21	44.3	23.9	7.2	13.2
ECAC21	44.5	24.1	7.2	13.2
ECAD21	44.5	24.2	7.3	13.0
ECBB21	44.5	24.1	7.1	13.3
ECBC21	44.6	24.2	7.3	13.1
ECBD21	44.8	24.2	7.4	13.3
ECCC21	42.6	23.9	6.6	12.0
ECCD21	42.8	24.0	6.7	12.1
EDAA21	42.7	23.7	6.8	12.2
EDAB21	42.7	23.9	6.7	12.2
EDAC21	42.6	23.7	6.7	12.2
EDBB21	42.6	23.9	6.7	12.0
EDBC21	42.7	23.8	6.8	12.2
EDBD21	42.5	23.7	6.7	12.1
EDCC21	42.5	23.7	6.7	12.0
GAAA21	43.5	22.6	6.4	14.5
GAAB21	43.3	22.6	6.6	14.1
GAAC21	43.5	22.8	6.6	14.1
GAAD21	44.4	23.0	7.0	14.3
GAAE21	44.2	23.0	6.9	14.3
GABB21	42.8	22.5	6.5	13.7

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
GABC21	42.6	22.5	6.4	13.8
GABD21	42.7	22.6	6.3	13.9
GACC21	42.6	22.6	6.4	13.7
GACD21	42.5	22.6	6.4	13.4
GBAA21	43.4	22.6	6.5	14.2
GBAB21	43.1	22.5	6.7	14.0
GBAC21	43.1	22.5	6.6	14.0
GBAD21	43.1	22.6	6.5	14.1
GBBB21	42.8	22.5	6.6	13.7
GBBC21	42.9	22.4	6.6	13.8
GBBD21	42.8	22.6	6.3	13.9
GBCC21	42.6	22.4	6.4	13.8
GCAA21	42.9	22.4	6.6	14.0
GCAB21	42.5	22.2	6.5	13.8
GCAC21	42.8	22.4	6.5	13.9
GCAD21	42.7	22.4	6.5	13.9
GCBB21	42.7	22.3	6.7	13.6
GDAA21	42.7	22.3	6.8	13.6
ABAE31	54.2	28.9	10.8	14.5
BBAE31	53.1	28.4	10.6	14.1
CBAE31	51.9	28.0	10.1	13.7
DBAE31	50.3	27.5	9.5	13.3
EBAE31	49.0	26.6	9.3	13.1
ABAE32	58.3	28.8	11.9	17.6
BBAE32	56.7	27.8	11.5	17.4
CBAE32	56.2	27.6	11.3	17.3
DBAE32	55.1	27.3	10.7	17.1
EBAE32	54.0	26.1	11.0	16.9
ABAE33	61.3	29.1	13.6	18.7
BBAE33	59.2	28.3	12.9	18.0
CBAE33	58.1	27.8	12.6	17.7
DBAE33	57.3	27.5	12.1	17.7
EBAE33	54.2	24.9	10.8	18.5
ABAE41	54.2	28.8	10.9	14.5
BBAE41	52.8	28.1	10.8	13.9
CBAE41	52.2	27.9	10.6	13.7
DBAE41	51.0	27.6	10.0	13.4

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
EBAE41	49.5	26.6	9.9	13.0
ABAE42	58.4	28.6	12.6	17.2
BBAE42	56.6	27.8	12.0	16.8
CBAE42	56.0	27.5	11.7	16.8
DBAE42	54.5	26.9	11.2	16.5
EBAE42	53.8	26.2	10.9	16.7
ABAE43	62.3	29.6	13.7	18.9
BBAE43	60.4	28.7	13.1	18.6
CBAE43	59.2	28.2	12.8	18.2
DBAE43	57.2	27.7	11.9	17.7
EBAE43	54.1	24.7	10.6	18.7
ABAE51	53.5	28.6	11.6	13.2
BBAE51	52.0	28.0	11.2	12.8
CBAE51	51.4	27.9	10.9	12.7
DBAE51	50.0	27.3	10.2	12.5
EBAE51	49.8	26.5	10.5	12.8
ABAE52	57.5	28.6	12.7	16.2
BBAE52	56.6	27.9	12.6	16.2
CBAE52	56.4	28.0	12.3	16.1
DBAE52	53.8	26.5	11.3	16.1
EBAE52	54.6	26.1	11.7	16.8
ABAE53	60.6	29.5	13.9	17.3
BBAE53	59.5	28.7	13.4	17.3
CBAE53	59.3	28.6	13.3	17.4
DBAE53	57.7	27.9	12.3	17.5
EBAE53	57.3	27.1	12.3	18.0
ABAE61	52.8	29.2	11.1	12.5
BBAE61	52.5	29.2	10.9	12.5
CBAE61	52.0	28.9	10.5	12.6
DBAE61	50.6	28.0	9.7	12.9
EBAE61	49.0	27.0	9.1	12.9
ABAE62	58.2	29.5	12.9	15.8
BBAE62	58.0	29.4	12.8	15.8
CBAE62	56.1	28.3	11.7	16.0
DBAE62	56.3	28.3	11.8	16.1
EBAE62	51.8	25.4	9.8	16.7
ABAE63	61.5	30.2	14.5	16.8

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
BBAE63	60.9	29.7	14.2	17.0
CBAE63	59.3	28.6	13.7	17.0
DBAE63	58.8	28.2	13.4	17.2
EBAE63	55.9	25.6	12.0	18.3
ABAE71	53.9	28.7	11.1	14.1
BBAE71	53.3	28.2	10.9	14.2
CBAE71	52.2	28.0	10.5	13.6
DBAE71	50.2	27.5	9.7	13.0
EBAE71	49.8	26.6	10.3	12.8
ABAE72	59.7	28.4	13.3	18.0
BBAE72	59.0	27.8	13.0	18.2
CBAE72	58.1	27.5	12.6	17.9
DBAE72	56.5	27.0	12.1	17.4
EBAE72	56.1	26.2	12.3	17.6
ABAE73	62.2	28.6	14.4	19.2
BBAE73	60.5	27.9	13.8	18.9
CBAE73	60.1	27.6	13.5	18.9
DBAE73	58.2	27.2	12.6	18.3
EBAE73	57.4	26.2	12.2	19.0
ABAE81	51.8	28.9	11.1	11.9
BBAE81	51.8	29.0	11.0	11.9
CBAE81	51.1	28.6	10.6	11.9
DBAE81	49.6	27.5	10.0	12.2
EBAE81	45.2	24.5	8.1	12.6
ABAE82	57.9	29.5	12.9	15.4
BBAE82	57.6	29.4	12.7	15.4
CBAE82	54.9	28.1	11.4	15.3
DBAE82	56.3	28.6	12.1	15.6
EBAE82	52.2	25.6	9.6	17.0
ABAE83	61.8	30.6	14.7	16.5
BBAE83	60.0	29.3	14.0	16.7
CBAE83	59.4	28.7	14.1	16.7
DBAE83	57.5	27.9	12.7	16.9
EBAE83	54.7	25.9	10.7	18.2
ABAE91	53.7	28.7	11.4	13.6
BBAE91	52.8	28.1	11.1	13.5
CBAE91	51.9	28.0	10.9	13.1

Table 9-1. Average annual warmwater fish habitat in the Missouri River over the 96-year simulation period (in miles).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam
DBAE91	49.8	27.2	10.0	12.5
EBAE91	48.5	26.2	10.4	11.9
ABAE92	60.1	28.2	13.8	18.1
BBAE92	59.6	27.8	13.8	18.1
CBAE92	58.7	27.4	13.4	17.8
DBAE92	56.6	26.9	12.7	17.0
EBAE92	55.6	25.8	12.6	17.3
ABAE93	62.1	28.9	14.4	18.8
BBAE93	60.5	28.3	14.0	18.2
CBAE93	59.3	27.7	13.4	18.2
DBAE93	58.7	27.3	13.4	18.0
EBAE93	54.1	24.4	11.5	18.2
EVQ2XX	57.8	27.7	12.1	18.0

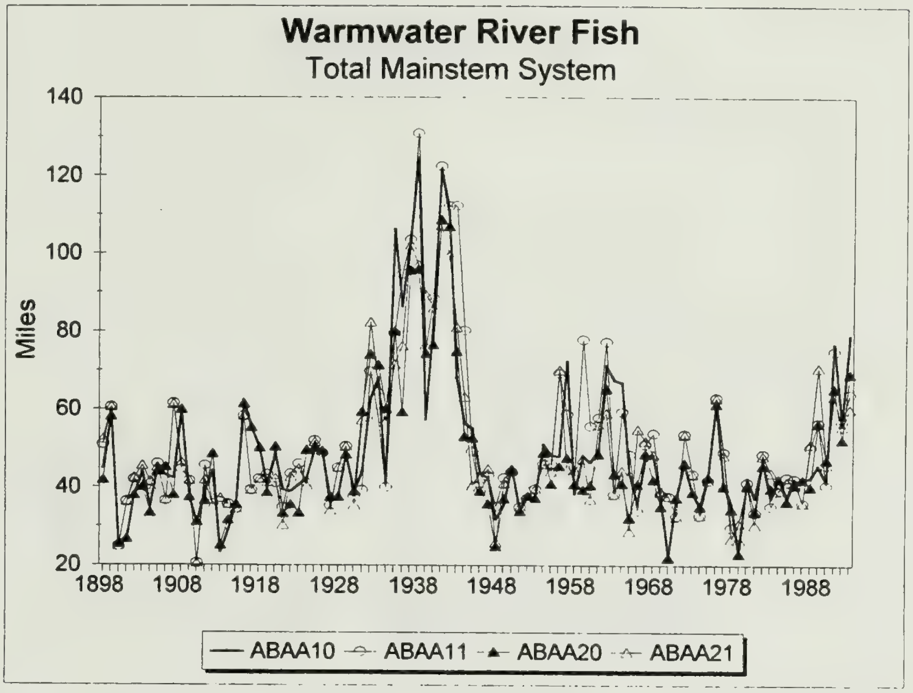

Figure 9-1. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

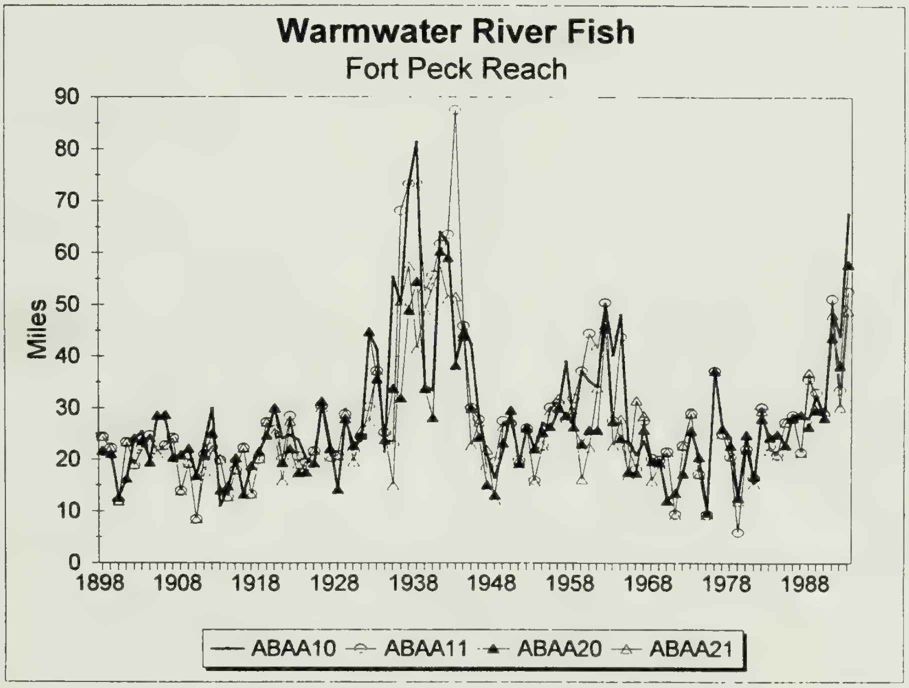

Figure 9-2. Annual average miles of warmwater fish habitat below Fort Peck Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

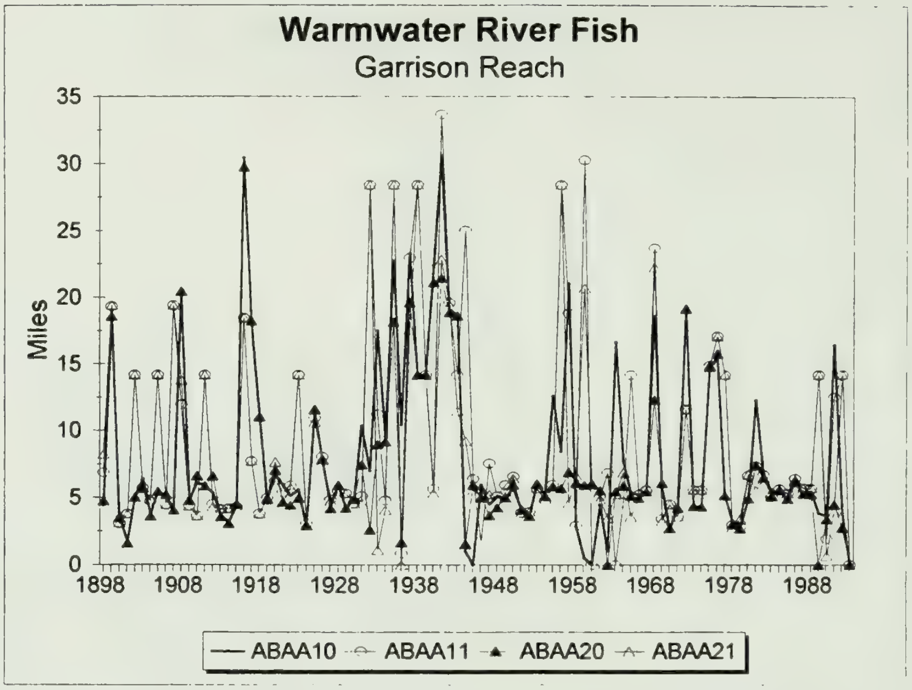

Figure 9-3. Annual average miles of warmwater fish habitat below Garrison Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

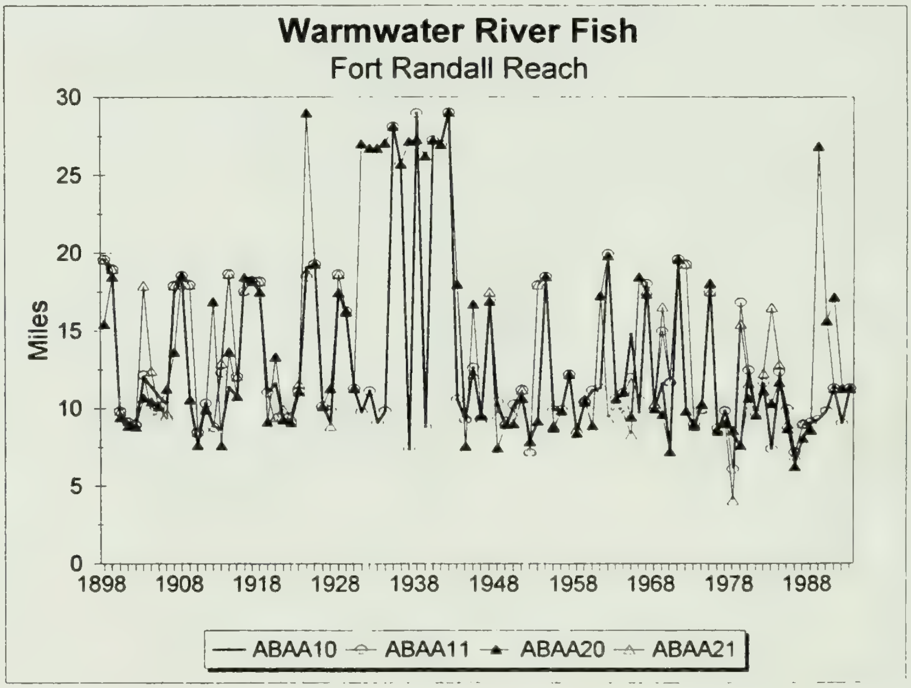

Figure 9-4. Annual average miles of warmwater fish habitat below Fort Randall Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

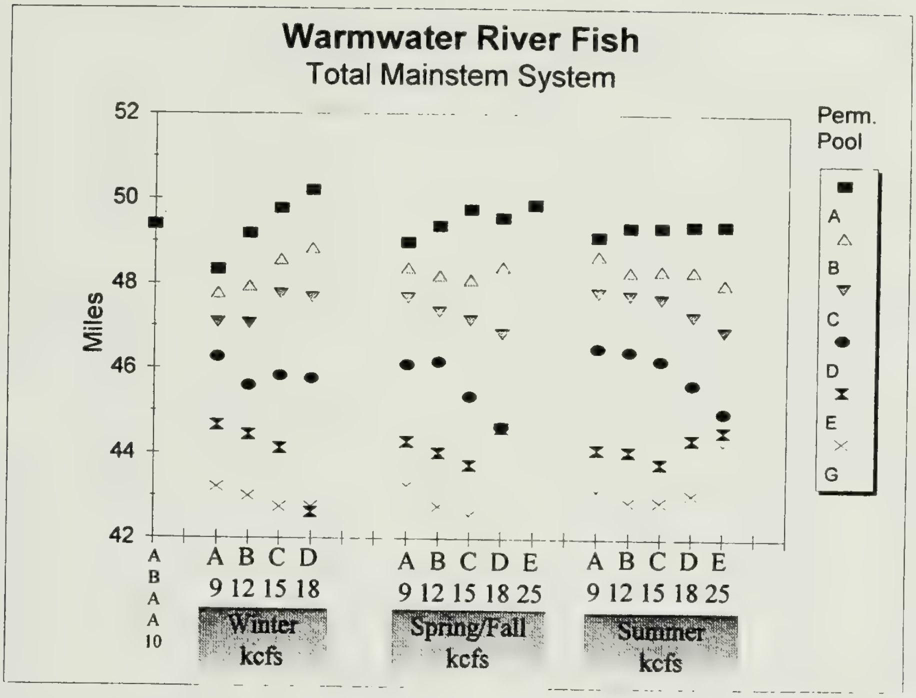

Figure 9-5. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period by nonnavigation service level.

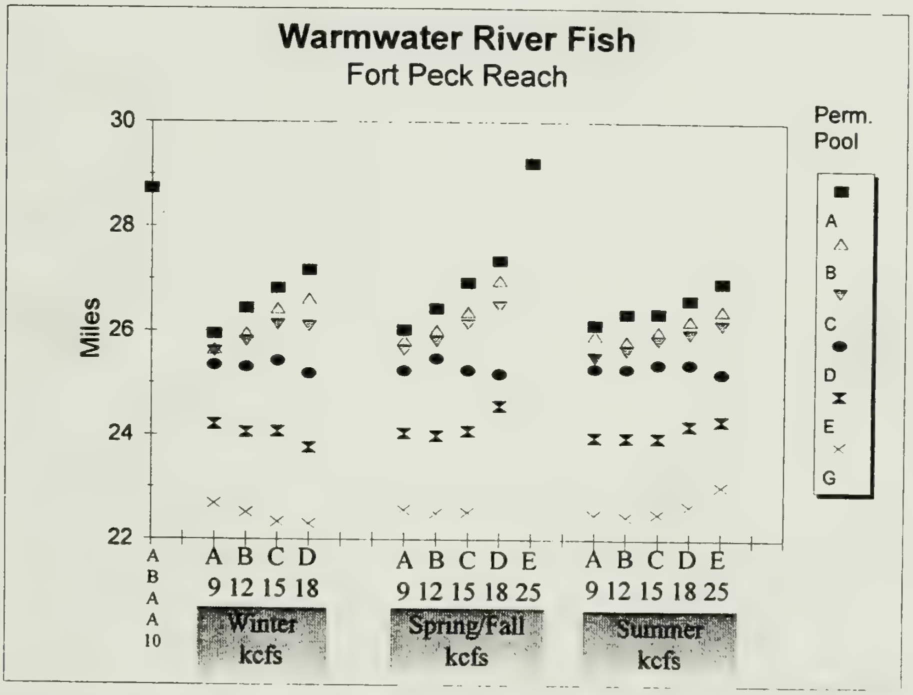

Figure 9-6. Annual average miles of warmwater fish habitat below Fort Peck Dam over the 96-year simulation period by nonnavigation service level.

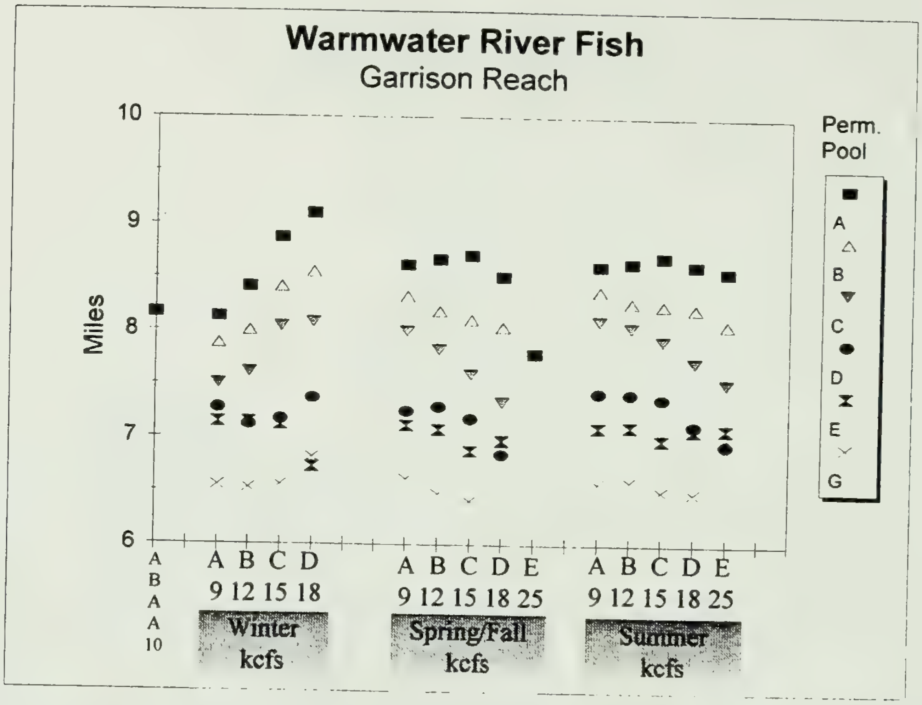

Figure 9-7. Annual average miles of coldwater fish habitat below Garrison Dam over the 96-year simulation period by nonnavigation service level.

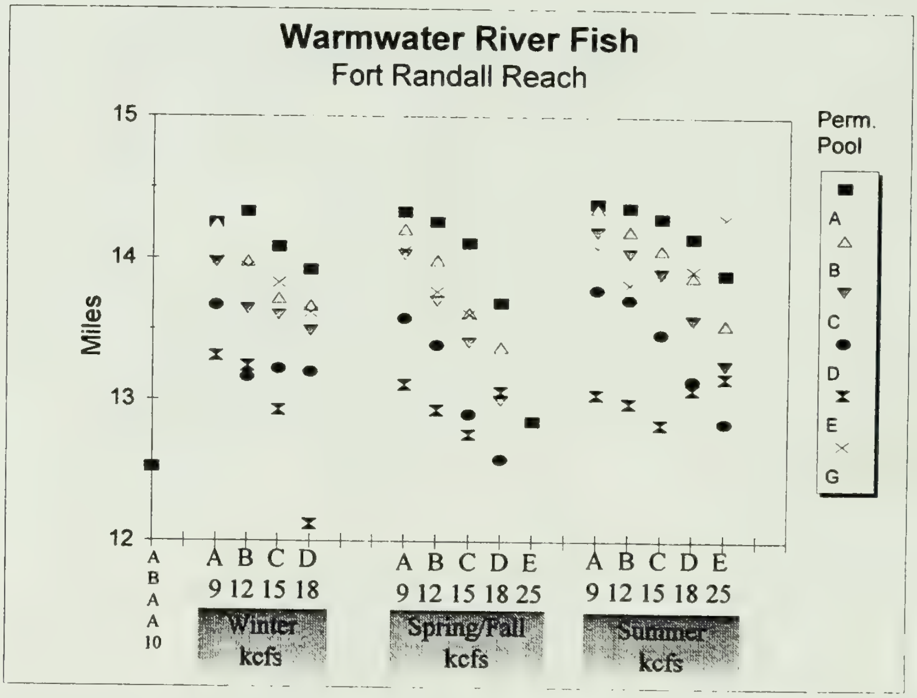

Figure 9-8. Annual average miles of coldwater fish habitat below Fort Randall Dam over the 96-year simulation period by nonnavigation service level.

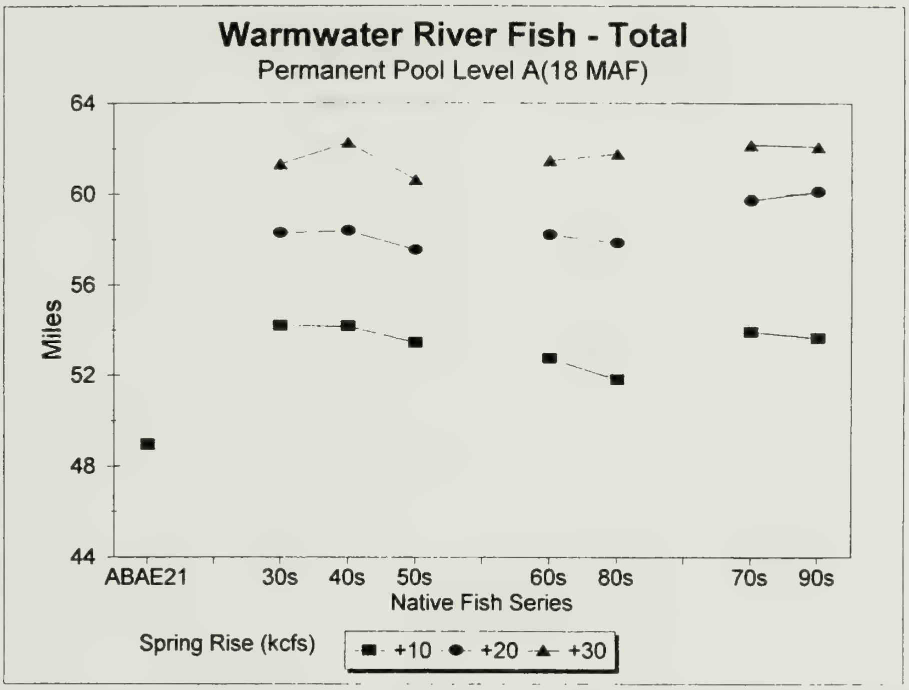

Figure 9-9. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

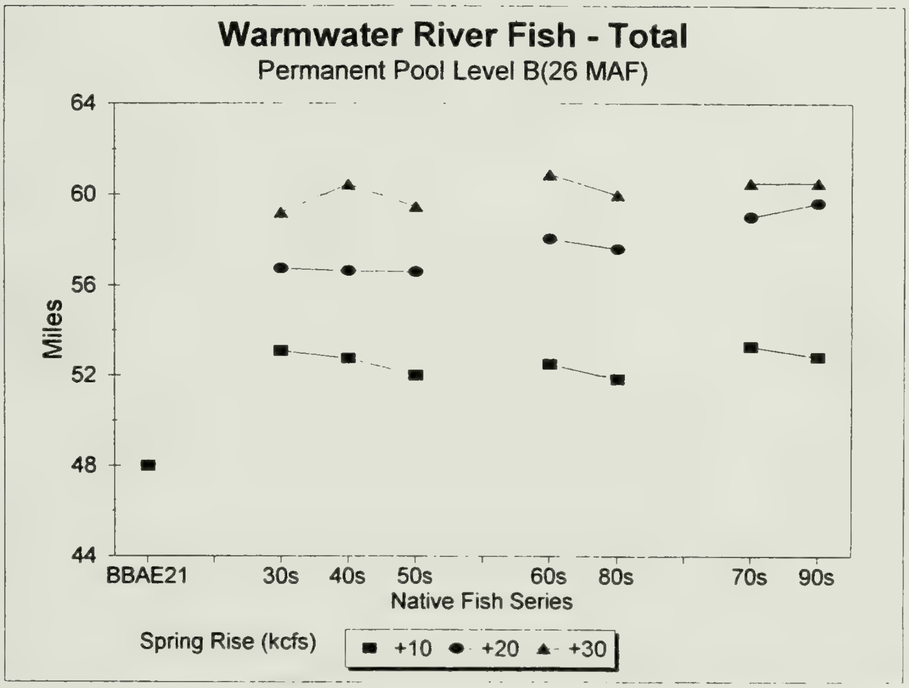

Figure 9-10. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

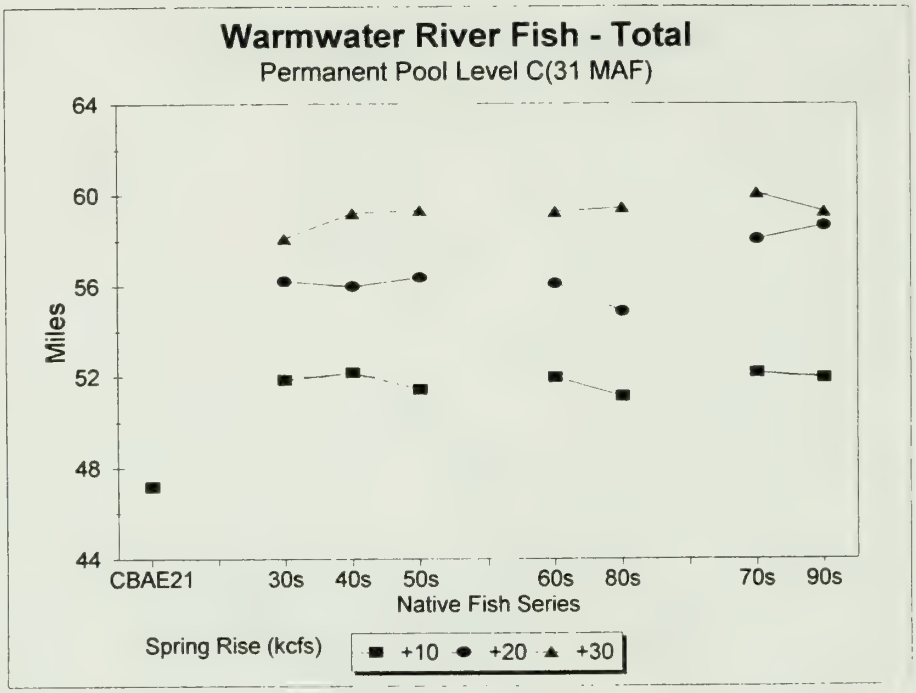

Figure 9-11. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

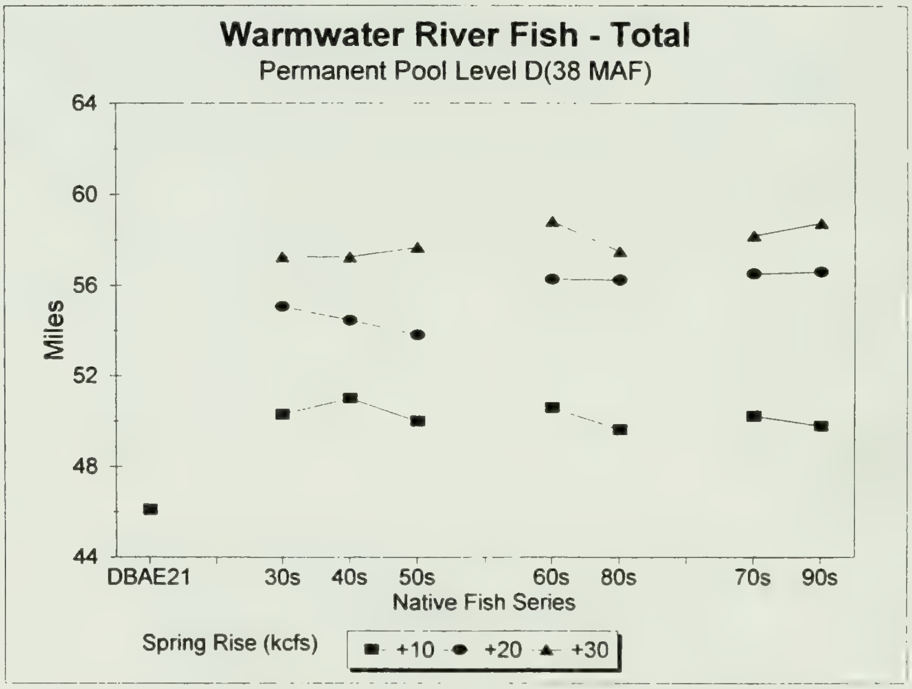

Figure 9-12. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

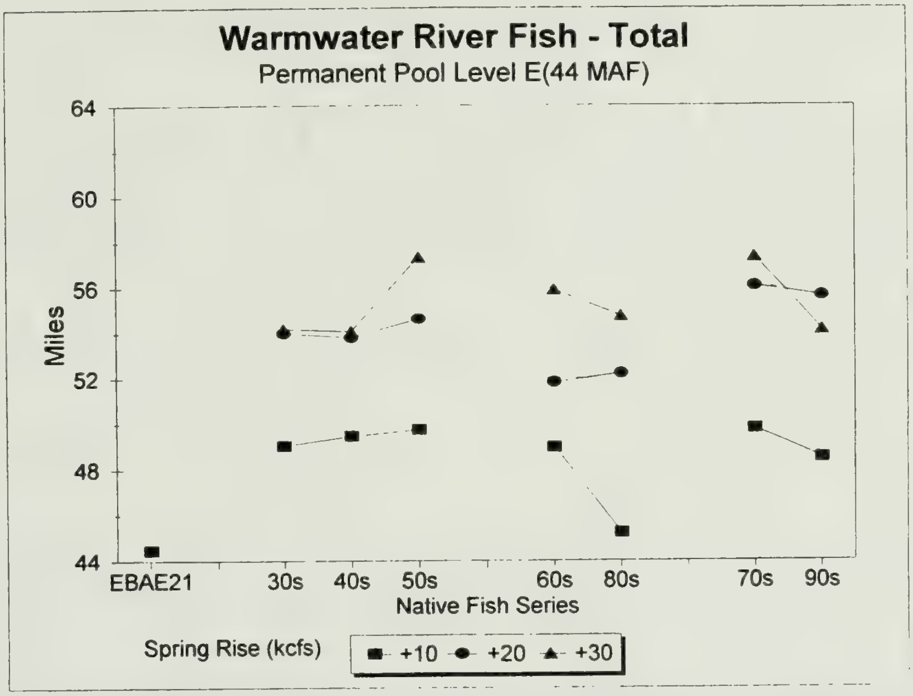

Figure 9-13. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

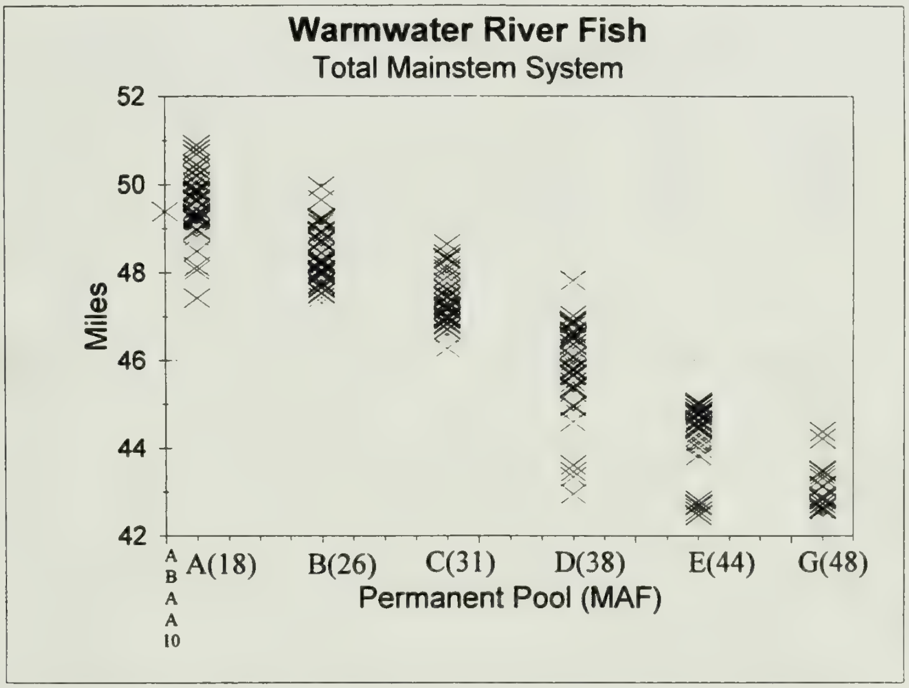

Figure 9-14. Annual average miles of warmwater fish habitat below three mainstem lakes over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

10.0 NATIVE RIVER FISH PHYSICAL HABITAT

The native river fish physical habitat index measures the similarity of simulated monthly cross-sectional flow patterns to historical patterns (Corps, 1994f and 1994g). Higher index values signify greater similarity to historical patterns and better habitat quality. The average annual native fish physical habitat index modeled for each alternative is shown in Table 10-1 at the end of the narrative section.

10.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

10.1.1 Total System

The modified navigation and intrasystem regulation criteria would have a slight positive effect on total river physical native fish habitat below the mainstem lakes. The lower dam releases associated with the modified navigation criteria in drought periods lead to slightly higher (1 to 2 percent) average index of habitat over the 96-year simulation period (Table 10-2). The difference occurs in drought periods (1930s, late 1950s, and late 1980s; Figure 10-1). Modified intrasystem regulation increases the index slightly (1 percent), with the increase occurring sporadically over the 96-year simulation period.

Table 10-2. Average of the annual index of native fish physical habitat below the mainstem lakes over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total Index	Below Fort Peck Dam	Below Garrison Dam	Below Fort Randall Dam	Below Gavins Point Dam
Current	Current	ABAA10	59.0	9.2	7.9	8.6	9.4
Modified	Current	ABAA20	59.7	9.3	8.0	8.5	9.4
Current	Modified	ABAA11	59.5	9.2	7.8	8.6	9.4
Modified	Modified	ABAA21	60.5	9.3	7.9	8.6	9.4

Service Level	Intrasystem Regulation	Alternative	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
Current	Current	ABAA10	4.0	5.1	4.6	4.9	5.3
Modified	Current	ABAA20	4.1	5.3	4.8	5.0	5.3
Current	Modified	ABAA11	4.3	5.2	4.7	5.0	5.3
Modified	Modified	ABAA21	4.5	5.5	4.9	5.1	5.4

10.1.2 Missouri River Below Fort Peck Dam

Below Fort Peck Dam, the physical habitat index is higher under the modified navigation criteria (Table 10-2; Figure 10-2), because dam releases would be lower in summer and fall, especially during and following the droughts of the 1930s, late 1950s, and late 1980s. There is little difference in the habitat index with modified intrasystem regulation (Table 10-2; Figure 10-2).

10.1.3 Missouri River Below Garrison Dam

As below Fort Peck Dam, the average index of physical habitat increases slightly below Garrison Dam with the modified navigation criteria (Table 10-2; Figure 10-3). Again, the difference occurs primarily during and following drought periods. Modified intrasystem regulation leads to slightly lower average habitat index that is due to sporadic, but sharply lower indices over the 96-year simulation period (Figure 10-3).

10.1.4 Missouri River Below Fort Randall Dam

There is little difference in the physical habitat index from the modified navigation or intrasystem regulation criteria in the reach below Fort Randall Dam (Figure 10-4).

10.1.5 Missouri River Below Gavins Point Dam

There is little difference in the physical habitat index from the modified navigation or intrasystem regulation criteria in the reach below Gavins Point Dam (Figure 10-5).

10.1.6 Missouri River in Sioux City Reach

There is a slight increase (3 to 5 percent) in the physical habitat index from the modified navigation criteria in the Sioux City reach (Table 10-2; Figure 10-6). The increase occurs primarily during and following the droughts of the 1930s, late 1950s, and late 1980s. Physical habitat also improves with modified intrasystem regulation; improvement occurs sporadically over the 96-year simulation period (Figure 10-6).

10.1.7 Missouri River in Nebraska City Reach

A pattern similar to that at Sioux City occurs for the Nebraska City reach (Table 10-2; Figure 10-7).

10.1.8 Missouri River in St. Joseph Reach

A pattern similar to that at Sioux City occurs for the St. Joseph reach (Table 10-2; Figure 10-8).

10.1.9 Missouri River in Boonville Reach

A pattern similar to that at Sioux City occurs for the Boonville reach (Table 10-2; Figure 10-9).

10.1.10 Missouri River in Hermann Reach

There is little effect in physical habitat of native fish from the modified navigation or intrasystem regulation criteria (Table 10-2; Figure 10-10).

10.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

10.2.1 Total System

Total native fish physical habitat in the riverine portions of the Missouri River Mainstem System increases slightly with higher minimum nonnavigation service levels, particularly for winter and spring/fall (Figure 10-11). The differences occur primarily in drought periods.

10.2.2 Missouri River Below Fort Peck Dam

There is no distinct pattern below Fort Peck Dam (Figure 10-12).

10.2.3 Missouri River Below Garrison Dam

There is no distinct pattern below Garrison Dam (Figure 10-13).

10.2.4 Missouri River Below Fort Randall Dam

Below Fort Randall Dam native fish physical habitat declines with increasing winter minimum service level above 12 kcfs (Figure 10-14). Higher winter flows during drought periods reduce the physical habitat index. In spring through fall, the habitat index is slightly lower at low and high minimum nonnavigation service levels when compared to intermediate levels (15 and 18 kcfs).

10.2.5 Missouri River Below Gavins Point Dam

A pattern similar to that below Fort Randall Dam occurs below Gavins Point Dam (Figure 10-15).

10.2.6 Missouri River in Sioux City Reach

Physical fish habitat in the Sioux City reach declines at higher winter minimum service levels and improves at higher minimum spring through fall service levels (Figure 10-16). These differences occur mainly in drought periods.

10.2.7 Missouri River in Nebraska City Reach

Physical habitat in the Nebraska City reach generally improves with higher minimum service levels for all seasons, with the exception of the highest minimum service levels (Figure 10-17).

10.2.8 Missouri River in St. Joseph Reach

The pattern in the St. Joseph reach is similar to the pattern in the Nebraska City reach (Figure 10-18).

10.2.9 Missouri River in Boonville Reach

Physical habitat in the Boonville Reach generally improves with higher minimum nonnavigation service levels, with the exception of a decline at higher winter minimum service levels (Figure 10-19).

10.2.10 Missouri River in Hermann Reach

Physical habitat in the Hermann reach declines at winter minimum service levels above 12 kcfs, but increases slightly with increasing spring through fall minimum nonnavigation service levels (Figure 10-20).

10.3 EFFECT OF NATIVE FISH SERIES

Increasing spring releases from storage increases total native fish physical habitat in the riverine portions of the Mainstem System up to an average of 2 percent over the 96-year simulation period (Figures 10-21 through 10-25). The increase occurs in nondrought years and is slightly greater for lower permanent pools. Eliminating flood control constraints for the spring releases further improves the native fish habitat index. Eliminating navigation support in late summer or fall also improves the habitat index. Most of the improvements described above occur in the lower navigation portion of the Missouri River from Sioux City to Hermann.

10.4 PERMANENT POOL LEVEL

An increase in the permanent pool level tends to decrease total native fish river physical habitat (Figure 10-26).

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
ABAA10	59.0	9.2	7.9	8.6	9.4	4.0	5.1	4.6	4.9	5.3
ABAA11	59.5	9.2	7.8	8.6	9.4	4.3	5.2	4.7	5.0	5.3
ABAA20	59.7	9.3	8.0	8.5	9.4	4.1	5.3	4.8	5.0	5.3
AAAA21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
AAAB21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
AAAC21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
AAAD21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
AAAE21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
AABB21	60.1	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
AABC21	60.1	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
AABD21	60.1	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
AABE21	60.1	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
AACC21	60.3	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.2	5.4
AACD21	60.3	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.2	5.4
AACE21	60.3	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.2	5.4
AADD21	60.3	9.2	7.9	8.6	9.4	4.5	5.4	4.8	5.2	5.4
AADE21	60.4	9.2	7.9	8.6	9.4	4.5	5.4	4.8	5.2	5.4
AAEE21	59.7	9.2	7.9	8.5	9.3	4.1	5.2	4.7	5.2	5.5
ABAA21	60.5	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.4
ABAB21	60.5	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.4
ABAC21	60.5	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.4
ABAD21	60.5	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.4
ABAE21	60.5	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.4
ABBB21	60.7	9.3	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.4
ABBC21	60.7	9.3	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.4
ABBD21	60.8	9.3	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.4

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
ABBE21	60.8	9.3	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.4
ABCC21	61.0	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
ABCD21	61.0	9.3	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
ABCE21	61.0	9.3	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
ABDD21	61.0	9.2	7.9	8.6	9.5	4.5	5.6	5.0	5.2	5.4
ABDE21	61.1	9.2	7.9	8.6	9.5	4.5	5.6	5.0	5.2	5.4
ACAA21	60.9	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
ACAB21	60.9	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
ACAC21	60.8	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
ACAD21	60.8	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
ACAE21	60.9	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
ACBB21	61.1	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.1	5.3
ACBC21	61.1	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.1	5.3
ACBD21	61.2	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.1	5.3
ACBE21	61.1	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.1	5.3
ACCC21	61.3	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
ACCD21	61.4	9.3	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
ACCE21	61.2	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
ACDD21	61.5	9.2	7.9	8.6	9.5	4.5	5.9	5.1	5.3	5.4
ACDE21	61.6	9.2	7.9	8.6	9.5	4.5	5.9	5.1	5.3	5.4
ADAA21	60.4	9.2	7.9	8.5	9.4	4.1	5.7	5.1	5.1	5.3
ADAB21	60.4	9.2	7.9	8.5	9.4	4.1	5.7	5.1	5.1	5.3
ADAC21	60.3	9.2	7.9	8.5	9.4	4.1	5.7	5.0	5.1	5.3
ADAD21	60.4	9.2	7.9	8.5	9.4	4.1	5.7	5.0	5.1	5.3
ADAE21	60.3	9.2	7.9	8.5	9.4	4.1	5.7	5.0	5.1	5.3
ADBB21	60.7	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
ADBC21	60.7	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
ADBD21	60.6	9.2	7.9	8.6	9.5	4.2	5.7	5.1	5.1	5.3
ADBE21	60.6	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
ADCC21	60.8	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
ADCD21	60.8	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
ADCE21	60.9	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
ADDD21	61.0	9.2	7.9	8.6	9.6	4.2	5.8	5.1	5.2	5.3
ADDE21	61.0	9.3	7.9	8.6	9.6	4.2	5.9	5.1	5.2	5.3
BAAA21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
BAAB21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
BAAC21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
BAAD21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
BAAE21	59.8	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
BABB21	60.1	9.3	7.9	8.6	9.3	4.5	5.3	4.8	5.1	5.3
BABC21	60.1	9.3	7.9	8.6	9.3	4.5	5.3	4.8	5.1	5.3
BABD21	60.1	9.3	7.9	8.6	9.3	4.5	5.3	4.8	5.1	5.3
BABE21	60.1	9.3	7.9	8.6	9.3	4.5	5.3	4.8	5.1	5.3
BACC21	60.2	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
BACD21	60.3	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
BACE21	60.3	9.2	7.9	8.6	9.4	4.5	5.3	4.8	5.1	5.3
BADD21	60.3	9.2	7.9	8.6	9.4	4.5	5.4	4.8	5.2	5.3
BADE21	60.3	9.2	7.9	8.5	9.4	4.5	5.4	4.8	5.2	5.3
BBAA21	60.4	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.3
BBAB21	60.3	9.2	7.9	8.6	9.4	4.4	5.4	4.9	5.1	5.3
BBAC21	60.4	9.2	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.3
BBAD21	60.4	9.2	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
BBAE21	60.4	9.3	7.9	8.6	9.4	4.5	5.5	4.9	5.1	5.3
BBBB21	60.7	9.2	7.9	8.6	9.4	4.6	5.5	5.0	5.1	5.3
BBBC21	60.7	9.2	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.3
BBBD21	60.8	9.2	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.3
BBBE21	60.6	9.2	7.9	8.6	9.4	4.5	5.5	5.0	5.1	5.3
BBCC21	60.9	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.1	5.4
BBCD21	60.9	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.1	5.3
BBCE21	60.9	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.1	5.3
BBDD21	60.9	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
BBDE21	61.0	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
BCAA21	60.7	9.2	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
BCAB21	60.7	9.2	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
BCAC21	60.8	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
BCAD21	60.7	9.2	7.9	8.6	9.4	4.4	5.7	5.0	5.1	5.3
BCAE21	60.6	9.2	7.9	8.6	9.4	4.4	5.7	5.0	5.1	5.3
BCBB21	61.0	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
BCBC21	61.0	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
BCBD21	61.0	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
BCBE21	61.0	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
BCCC21	61.1	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
BCCD21	61.2	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
BCCE21	61.0	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
BCDD21	61.4	9.2	7.9	8.6	9.5	4.6	5.8	5.1	5.2	5.3
BCDE21	61.4	9.2	7.9	8.6	9.5	4.6	5.9	5.1	5.2	5.3
BDAA21	60.1	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.2
BDAB21	60.2	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.1	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
BDAC21	60.2	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.1	5.3
BDAD21	60.1	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.1	5.3
BDAE21	60.1	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.3
BDBB21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.0	5.0	5.3
BDBC21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.0	5.1	5.3
BDBD21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.0	5.1	5.3
BDBE21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.0	5.0	5.2
BDCC21	60.7	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
BDCD21	60.8	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.3
BDCE21	60.7	9.2	7.9	8.6	9.5	4.2	5.8	5.1	5.1	5.2
BDDD21	60.9	9.2	7.9	8.6	9.6	4.2	5.8	5.1	5.1	5.3
CAAA21	59.8	9.3	7.9	8.5	9.3	4.4	5.2	4.8	5.0	5.3
CAAB21	59.8	9.3	7.9	8.5	9.3	4.4	5.2	4.8	5.0	5.3
CAAC21	59.8	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
CAAD21	59.8	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
CAAE21	59.8	9.3	7.9	8.5	9.3	4.4	5.2	4.8	5.1	5.3
CABB21	60.1	9.3	7.9	8.5	9.3	4.5	5.3	4.8	5.1	5.3
CABC21	60.1	9.3	7.9	8.5	9.3	4.5	5.3	4.8	5.1	5.3
CABD21	60.0	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.1	5.3
CABE21	60.1	9.3	7.9	8.5	9.3	4.5	5.3	4.8	5.1	5.3
CACC21	60.3	9.3	7.9	8.5	9.4	4.5	5.3	4.9	5.1	5.4
CACD21	60.3	9.3	7.9	8.5	9.4	4.5	5.3	4.9	5.1	5.3
CACE21	60.3	9.3	7.9	8.5	9.4	4.5	5.3	4.9	5.1	5.4
CADD21	60.3	9.3	7.9	8.5	9.4	4.5	5.3	4.8	5.1	5.4
CADE21	60.3	9.3	7.9	8.5	9.4	4.5	5.3	4.8	5.2	5.4
CBAA21	60.4	9.3	8.0	8.5	9.4	4.5	5.5	4.9	5.0	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
CBAB21	60.3	9.3	7.9	8.5	9.4	4.4	5.4	4.9	5.1	5.3
CBAC21	60.4	9.3	8.0	8.5	9.4	4.5	5.4	4.9	5.1	5.3
CBAD21	60.3	9.3	8.0	8.5	9.4	4.5	5.4	4.9	5.1	5.3
CBAE21	60.4	9.3	7.9	8.5	9.4	4.5	5.4	4.9	5.1	5.3
CBBB21	60.6	9.3	8.0	8.6	9.4	4.5	5.5	5.0	5.1	5.3
CBBC21	60.7	9.3	8.0	8.6	9.4	4.6	5.5	4.9	5.1	5.3
CBBD21	60.7	9.3	8.0	8.6	9.4	4.6	5.5	5.0	5.1	5.3
CBBE21	60.6	9.3	7.9	8.6	9.4	4.6	5.5	5.0	5.1	5.3
CBCC21	60.9	9.3	8.0	8.6	9.5	4.6	5.6	5.0	5.1	5.3
CBCD21	60.9	9.3	8.0	8.6	9.5	4.6	5.5	5.0	5.1	5.3
CBCE21	60.8	9.2	8.0	8.6	9.5	4.5	5.5	5.0	5.1	5.3
CBDD21	61.0	9.3	8.0	8.6	9.5	4.6	5.6	5.0	5.1	5.3
CBDE21	61.0	9.3	7.9	8.6	9.5	4.6	5.6	5.0	5.2	5.4
CCAA21	60.6	9.3	8.0	8.5	9.4	4.4	5.7	5.1	5.1	5.3
CCAB21	60.7	9.3	7.9	8.5	9.4	4.4	5.7	5.1	5.1	5.3
CCAC21	60.7	9.3	7.9	8.6	9.4	4.4	5.7	5.1	5.1	5.3
CCAD21	60.7	9.3	8.0	8.5	9.4	4.4	5.7	5.0	5.1	5.3
CCAE21	60.5	9.3	7.9	8.5	9.4	4.4	5.6	5.0	5.1	5.3
CCBB21	61.0	9.3	8.0	8.6	9.5	4.5	5.7	5.1	5.1	5.3
CCBC21	61.0	9.3	8.0	8.6	9.5	4.5	5.7	5.1	5.1	5.3
CCBD21	61.0	9.3	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
CCBE21	60.9	9.3	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
CCCC21	61.1	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
CCCD21	61.1	9.3	8.0	8.6	9.5	4.5	5.7	5.1	5.1	5.3
CCCE21	61.1	9.2	7.9	8.6	9.5	4.5	5.8	5.1	5.2	5.3
CCDD21	61.3	9.2	7.9	8.6	9.5	4.6	5.8	5.1	5.2	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
CDAA21	60.1	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.3
CDAB21	60.1	9.2	7.9	8.5	9.4	4.1	5.7	5.0	5.0	5.3
CDAC21	60.1	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.3
CDAD21	60.0	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.3
CDAE21	59.9	9.3	7.9	8.5	9.4	4.0	5.6	5.0	5.0	5.3
CDBB21	60.4	9.2	8.0	8.6	9.4	4.2	5.7	5.0	5.0	5.3
CDBC21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.0	5.0	5.2
CDBD21	60.4	9.3	8.0	8.6	9.5	4.2	5.7	5.0	5.0	5.2
CDBE21	60.3	9.2	7.9	8.6	9.4	4.1	5.7	5.0	5.1	5.2
CDCC21	60.6	9.2	8.0	8.6	9.5	4.2	5.7	5.1	5.1	5.2
CDCD21	60.6	9.2	7.9	8.6	9.5	4.2	5.7	5.1	5.1	5.2
CDDD21	60.9	9.2	8.0	8.6	9.5	4.2	5.8	5.1	5.1	5.3
DAAA21	59.7	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
DAAB21	59.7	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
DAAC21	59.7	9.2	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
DAAD21	59.8	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
DAAE21	59.8	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
DABB21	60.0	9.3	7.9	8.5	9.3	4.6	5.3	4.8	5.0	5.3
DABC21	60.1	9.3	7.9	8.5	9.3	4.6	5.3	4.8	5.1	5.3
DABD21	59.9	9.2	7.8	8.5	9.3	4.5	5.3	4.8	5.0	5.3
DABE21	60.0	9.3	7.9	8.5	9.3	4.6	5.3	4.8	5.1	5.3
DACC21	60.2	9.3	7.9	8.5	9.3	4.6	5.3	4.8	5.1	5.3
DACD21	60.2	9.3	7.9	8.5	9.3	4.6	5.3	4.8	5.1	5.3
DACE21	60.1	9.2	7.9	8.5	9.3	4.5	5.3	4.8	5.1	5.3
DADD21	60.3	9.2	7.9	8.5	9.4	4.6	5.4	4.8	5.1	5.3
DBAA21	60.2	9.3	7.9	8.5	9.3	4.4	5.4	4.9	5.0	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
DBAB21	60.2	9.3	7.9	8.5	9.4	4.4	5.4	4.9	5.0	5.3
DBAC21	60.2	9.3	8.0	8.5	9.4	4.5	5.4	4.9	5.0	5.3
DBAD21	60.3	9.3	8.0	8.5	9.4	4.5	5.4	4.9	5.0	5.3
DBAE21	60.2	9.3	7.9	8.5	9.3	4.5	5.4	4.9	5.0	5.3
DBBB21	60.5	9.2	8.0	8.6	9.4	4.6	5.5	4.9	5.0	5.3
DBBC21	60.6	9.3	8.0	8.6	9.4	4.6	5.5	4.9	5.1	5.3
DBBD21	60.6	9.2	7.9	8.6	9.4	4.6	5.5	5.0	5.1	5.3
DBBE21	60.4	9.2	7.9	8.6	9.4	4.6	5.5	4.9	5.1	5.3
DBCC21	60.8	9.2	8.0	8.6	9.5	4.6	5.6	5.0	5.1	5.3
DBCD21	60.7	9.2	7.9	8.6	9.5	4.6	5.5	5.0	5.1	5.2
DBDD21	60.9	9.2	7.9	8.6	9.5	4.6	5.6	5.0	5.1	5.3
DCAA21	60.4	9.2	7.9	8.5	9.4	4.4	5.6	5.0	5.0	5.2
DCAB21	60.4	9.2	7.9	8.5	9.4	4.3	5.6	5.1	5.1	5.3
DCAC21	60.5	9.2	7.9	8.5	9.4	4.4	5.6	5.1	5.1	5.2
DCAD21	60.5	9.2	7.9	8.5	9.4	4.4	5.6	5.1	5.1	5.2
DCAE21	60.2	9.2	7.9	8.5	9.4	4.3	5.6	5.0	5.0	5.2
DCBB21	60.6	9.3	7.9	8.6	9.4	4.5	5.6	5.0	5.0	5.2
DCBC21	60.8	9.3	7.9	8.6	9.4	4.5	5.7	5.1	5.1	5.3
DCBD21	60.8	9.3	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
DCBE21	60.3	9.3	8.0	8.5	9.4	4.3	5.6	5.0	5.1	5.2
DCCC21	60.9	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.2
DCCD21	60.9	9.2	7.9	8.6	9.5	4.5	5.7	5.1	5.1	5.3
DCDD21	60.9	9.3	8.0	8.5	9.5	4.4	5.8	5.0	5.2	5.2
DDAA21	59.7	9.2	7.9	8.5	9.4	4.0	5.6	5.0	4.9	5.2
DDAB21	59.7	9.2	7.9	8.5	9.3	4.0	5.6	5.0	5.0	5.2
DDAC21	59.8	9.2	7.9	8.5	9.4	4.1	5.6	5.0	5.0	5.2

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
DDAD21	59.8	9.2	7.9	8.5	9.4	4.0	5.6	5.0	5.0	5.2
DDAE21	59.4	9.3	7.9	8.5	9.3	3.9	5.5	4.9	5.0	5.1
DDBB21	60.1	9.2	7.9	8.6	9.4	4.1	5.7	5.0	5.0	5.2
DDBC21	60.3	9.2	7.9	8.6	9.4	4.2	5.7	5.0	5.0	5.2
DDBD21	60.2	9.2	7.9	8.6	9.4	4.2	5.7	5.0	5.0	5.2
DDCC21	60.4	9.2	7.9	8.6	9.5	4.2	5.7	5.1	5.0	5.2
DDCD21	60.1	9.3	8.0	8.5	9.5	4.0	5.7	5.0	5.0	5.1
EAAA21	59.4	9.3	8.0	8.4	9.2	4.4	5.2	4.8	5.0	5.2
EAAB21	59.4	9.3	8.0	8.4	9.2	4.4	5.2	4.8	5.0	5.2
EAAC21	59.6	9.2	8.0	8.5	9.3	4.4	5.2	4.8	5.0	5.3
EAAD21	59.7	9.2	8.0	8.4	9.3	4.4	5.3	4.8	5.1	5.3
EAAE21	59.7	9.3	7.9	8.5	9.3	4.5	5.2	4.8	5.0	5.3
EABB21	59.8	9.2	8.0	8.5	9.3	4.5	5.2	4.8	5.0	5.3
EABC21	60.0	9.2	8.0	8.5	9.3	4.6	5.3	4.8	5.1	5.3
EABD21	59.9	9.2	7.9	8.5	9.3	4.5	5.3	4.8	5.0	5.3
EABE21	59.9	9.3	7.9	8.5	9.3	4.6	5.2	4.8	5.0	5.3
EACC21	60.3	9.2	8.0	8.5	9.3	4.6	5.3	4.9	5.1	5.3
EACD21	60.3	9.3	7.9	8.5	9.4	4.6	5.3	4.9	5.1	5.3
EADD21	60.4	9.3	8.0	8.5	9.4	4.6	5.4	4.9	5.1	5.3
EBAA21	59.9	9.3	8.0	8.5	9.3	4.4	5.4	4.9	5.0	5.3
EBAB21	60.0	9.3	8.0	8.5	9.3	4.4	5.4	4.9	5.0	5.3
EBAC21	60.0	9.3	8.0	8.5	9.3	4.4	5.4	4.9	5.0	5.3
EBAD21	60.3	9.3	8.0	8.5	9.3	4.5	5.5	4.9	5.0	5.3
EBAE21	60.0	9.3	7.9	8.5	9.3	4.4	5.4	4.9	5.0	5.3
EBBB21	60.3	9.3	8.0	8.5	9.4	4.5	5.4	4.9	5.0	5.3
EBBC21	60.5	9.3	8.0	8.6	9.4	4.6	5.5	4.9	5.0	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
EBBD21	60.6	9.3	8.0	8.6	9.4	4.6	5.5	5.0	5.1	5.2
EBCC21	60.6	9.3	8.0	8.6	9.4	4.5	5.5	5.0	5.1	5.2
EBCD21	60.8	9.3	8.0	8.6	9.5	4.6	5.6	5.0	5.1	5.2
ECAA21	60.1	9.3	8.0	8.5	9.3	4.3	5.6	5.0	5.0	5.2
ECAB21	60.1	9.3	8.0	8.5	9.3	4.3	5.6	5.0	5.0	5.2
ECAC21	60.2	9.3	8.0	8.5	9.3	4.3	5.6	5.0	5.0	5.2
ECAD21	60.1	9.3	8.0	8.5	9.3	4.2	5.6	5.0	5.0	5.2
ECBB21	60.6	9.3	8.0	8.6	9.4	4.4	5.6	5.0	5.0	5.2
ECBC21	60.5	9.3	8.0	8.5	9.4	4.4	5.6	5.0	5.0	5.2
ECBD21	60.6	9.3	8.0	8.5	9.4	4.4	5.7	5.0	5.0	5.2
ECCC21	60.3	9.3	8.0	8.5	9.4	4.3	5.6	5.0	5.1	5.2
ECCD21	60.5	9.3	8.0	8.5	9.4	4.3	5.6	5.0	5.1	5.1
EDAA21	59.1	9.3	8.0	8.4	9.3	3.9	5.4	4.9	4.9	5.1
EDAB21	58.9	9.2	8.0	8.4	9.3	3.8	5.4	4.8	4.9	5.1
EDAC21	59.2	9.3	8.0	8.4	9.3	3.9	5.4	4.8	4.9	5.1
EDBB21	59.3	9.3	8.0	8.5	9.3	3.9	5.5	4.8	4.9	5.1
EDBC21	59.7	9.3	8.0	8.5	9.4	4.0	5.6	4.9	5.0	5.1
EDBD21	59.7	9.3	8.0	8.5	9.4	4.0	5.6	4.9	5.0	5.1
EDCC21	59.9	9.3	8.0	8.5	9.4	4.0	5.6	4.9	5.0	5.1
GAAA21	60.1	9.3	8.1	8.4	9.2	4.7	5.2	4.9	5.1	5.3
GAAB21	59.8	9.3	8.1	8.4	9.2	4.5	5.2	4.9	5.0	5.3
GAAC21	60.0	9.3	8.1	8.4	9.2	4.6	5.2	4.9	5.1	5.3
GAAD21	60.0	9.3	8.0	8.4	9.2	4.6	5.2	4.9	5.1	5.3
GAAE21	60.0	9.3	8.0	8.4	9.2	4.6	5.2	4.9	5.1	5.3
GABB21	59.8	9.3	8.1	8.4	9.2	4.4	5.2	4.9	5.0	5.2
GABC21	59.9	9.3	8.1	8.4	9.2	4.4	5.2	4.9	5.0	5.3

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
GABD21	60.2	9.3	8.1	8.4	9.3	4.5	5.3	4.9	5.1	5.3
GACC21	60.4	9.3	8.1	8.5	9.3	4.5	5.3	5.0	5.1	5.3
GACD21	60.3	9.3	8.1	8.5	9.3	4.5	5.3	5.0	5.1	5.3
GBAA21	60.0	9.3	8.1	8.4	9.2	4.4	5.4	5.0	5.0	5.2
GBAB21	60.1	9.3	8.1	8.4	9.3	4.4	5.4	5.0	5.0	5.2
GBAC21	60.2	9.3	8.1	8.4	9.3	4.4	5.4	5.0	5.0	5.2
GBAD21	60.5	9.3	8.1	8.4	9.3	4.5	5.5	5.1	5.1	5.3
GBBB21	59.9	9.3	8.1	8.4	9.3	4.3	5.4	5.0	5.0	5.2
GBBC21	60.9	9.3	8.1	8.5	9.4	4.6	5.5	5.1	5.1	5.3
GBBD21	60.8	9.3	8.1	8.5	9.4	4.6	5.5	5.1	5.1	5.2
GBCC21	60.4	9.3	8.1	8.5	9.4	4.5	5.5	5.0	5.0	5.2
GCAA21	59.5	9.3	8.1	8.4	9.2	4.1	5.4	5.0	4.9	5.2
GCAB21	59.7	9.3	8.1	8.4	9.2	4.1	5.5	5.0	5.0	5.1
GCAC21	59.7	9.3	8.1	8.4	9.2	4.2	5.4	5.0	5.0	5.1
GCAD21	59.9	9.3	8.1	8.4	9.3	4.2	5.5	5.0	5.0	5.1
GCBB21	60.1	9.3	8.1	8.4	9.3	4.3	5.5	5.1	5.0	5.1
GDAA21	58.8	9.3	8.1	8.3	9.2	3.8	5.4	4.9	4.8	5.1
ABAE31	61.7	9.4	8.0	8.7	9.5	4.4	5.7	5.1	5.4	5.5
BBAE31	61.6	9.4	8.0	8.7	9.5	4.4	5.7	5.1	5.4	5.5
CBAE31	61.5	9.4	8.0	8.6	9.5	4.4	5.7	5.1	5.4	5.5
DBAE31	61.3	9.4	8.0	8.6	9.5	4.3	5.6	5.1	5.3	5.4
EBAE31	61.3	9.4	8.0	8.6	9.5	4.4	5.6	5.1	5.3	5.4
ABAE32	63.1	9.4	8.0	8.7	9.6	4.7	6.1	5.4	5.6	5.6
BBAE32	63.0	9.4	8.0	8.7	9.6	4.7	6.0	5.4	5.6	5.6
CBAE32	63.1	9.4	8.0	8.7	9.6	4.7	6.1	5.4	5.6	5.6
DBAE32	62.8	9.4	8.0	8.7	9.6	4.6	6.0	5.4	5.6	5.5

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
EBAE32	62.7	9.4	8.0	8.7	9.5	4.6	6.0	5.5	5.5	5.5
ABAE33	64.3	9.4	8.1	8.8	9.7	5.0	6.3	5.7	5.7	5.7
BBAE33	64.1	9.4	8.0	8.8	9.6	4.9	6.2	5.7	5.7	5.7
CBAE33	64.2	9.4	8.0	8.8	9.6	5.0	6.2	5.7	5.8	5.7
DBAE33	63.8	9.4	8.0	8.7	9.6	4.8	6.2	5.7	5.7	5.6
EBAE33	63.8	9.5	8.1	8.7	9.5	4.9	6.1	5.7	5.8	5.5
ABAE41	62.5	9.4	8.0	8.7	9.6	4.6	5.9	5.3	5.4	5.5
BBAE41	62.4	9.4	8.0	8.7	9.6	4.6	5.8	5.3	5.5	5.5
CBAE41	62.4	9.4	8.0	8.7	9.6	4.6	5.8	5.3	5.4	5.5
DBAE41	62.2	9.4	8.0	8.7	9.6	4.5	5.8	5.3	5.4	5.4
EBAE41	62.1	9.4	8.1	8.6	9.6	4.5	5.8	5.3	5.4	5.4
ABAE42	63.7	9.4	8.0	8.8	9.7	4.8	6.2	5.5	5.6	5.6
BBAE42	63.7	9.4	8.0	8.8	9.7	4.9	6.1	5.5	5.6	5.6
CBAE42	63.7	9.4	8.0	8.8	9.7	4.9	6.2	5.6	5.6	5.6
DBAE42	63.4	9.4	8.0	8.7	9.6	4.8	6.1	5.5	5.6	5.5
EBAE42	63.4	9.5	8.1	8.7	9.6	4.8	6.1	5.6	5.6	5.5
ABAE43	64.6	9.4	8.1	8.8	9.7	5.0	6.3	5.8	5.8	5.7
BBAE43	64.7	9.4	8.1	8.8	9.7	5.1	6.3	5.8	5.8	5.7
CBAE43	64.7	9.4	8.1	8.8	9.7	5.1	6.3	5.8	5.8	5.7
DBAE43	64.4	9.5	8.1	8.8	9.7	5.0	6.2	5.8	5.8	5.6
EBAE43	64.2	9.5	8.1	8.7	9.6	5.0	6.2	5.9	5.8	5.5
ABAE51	63.1	9.5	8.1	8.8	9.7	4.7	6.0	5.3	5.5	5.5
BBAE51	63.0	9.5	8.1	8.8	9.7	4.7	5.9	5.3	5.5	5.5
CBAE51	63.0	9.5	8.1	8.8	9.7	4.7	5.9	5.3	5.5	5.5
DBAE51	62.8	9.5	8.1	8.7	9.7	4.6	5.9	5.3	5.5	5.5
EBAE51	62.7	9.5	8.1	8.7	9.6	4.7	5.9	5.4	5.5	5.4

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
ABAE52	64.2	9.5	8.1	8.8	9.7	4.9	6.3	5.6	5.7	5.6
BBAE52	64.2	9.5	8.1	8.8	9.7	5.0	6.2	5.6	5.7	5.6
CBAE52	64.2	9.5	8.1	8.8	9.7	4.9	6.3	5.6	5.7	5.7
DBAE52	64.0	9.5	8.1	8.8	9.7	4.9	6.2	5.6	5.7	5.6
EBAE52	63.9	9.5	8.1	8.8	9.7	4.9	6.2	5.6	5.7	5.5
ABAE53	65.1	9.5	8.1	8.9	9.7	5.2	6.4	5.9	5.8	5.7
BBAE53	65.1	9.5	8.1	8.9	9.7	5.2	6.4	5.8	5.8	5.7
CBAE53	65.3	9.5	8.1	8.8	9.7	5.3	6.4	5.9	5.9	5.7
DBAE53	65.0	9.5	8.1	8.8	9.7	5.2	6.4	5.9	5.8	5.7
EBAE53	64.8	9.5	8.1	8.8	9.7	5.1	6.4	5.9	5.8	5.6
ABAE61	63.4	9.4	8.1	8.7	9.8	4.8	6.0	5.4	5.7	5.5
BBAE61	63.3	9.4	8.1	8.7	9.8	4.8	6.0	5.4	5.7	5.5
CBAE61	63.2	9.4	8.1	8.7	9.8	4.8	6.0	5.4	5.6	5.5
DBAE61	63.0	9.4	8.1	8.6	9.7	4.8	6.0	5.4	5.5	5.4
EBAE61	63.1	9.4	8.1	8.6	9.7	4.8	6.0	5.5	5.6	5.4
ABAE62	64.9	9.4	8.1	8.7	9.8	5.2	6.3	5.7	5.9	5.7
BBAE62	64.8	9.4	8.1	8.7	9.8	5.2	6.3	5.7	5.9	5.7
CBAE62	64.7	9.5	8.1	8.7	9.8	5.2	6.3	5.7	5.9	5.6
DBAE62	64.4	9.4	8.1	8.7	9.8	5.2	6.3	5.7	5.8	5.5
EBAE62	64.4	9.4	8.1	8.6	9.7	5.1	6.3	5.7	5.8	5.6
ABAE63	65.7	9.4	8.1	8.7	9.9	5.4	6.4	6.0	6.0	5.8
BBAE63	65.6	9.4	8.1	8.7	9.9	5.4	6.4	5.9	6.0	5.8
CBAE63	65.7	9.5	8.1	8.7	9.9	5.4	6.4	5.9	6.0	5.8
DBAE63	65.4	9.4	8.1	8.7	9.8	5.4	6.3	5.9	5.9	5.7
EBAE63	65.3	9.4	8.1	8.7	9.8	5.4	6.5	6.0	5.8	5.6
ABAE71	64.0	9.4	8.1	8.7	9.7	4.8	6.3	5.6	5.7	5.5

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
BBAE71	63.9	9.4	8.1	8.7	9.7	4.9	6.3	5.6	5.7	5.5
CBAE71	63.8	9.4	8.1	8.7	9.7	4.9	6.3	5.6	5.7	5.5
DBAE71	63.6	9.4	8.1	8.7	9.7	4.8	6.2	5.5	5.6	5.5
EBAE71	63.4	9.5	8.1	8.6	9.7	4.8	6.2	5.6	5.6	5.4
ABAE72	65.6	9.5	8.1	8.8	9.8	5.2	6.7	6.0	5.9	5.6
BBAE72	65.5	9.5	8.1	8.8	9.8	5.2	6.7	6.0	5.9	5.6
CBAE72	65.4	9.5	8.1	8.8	9.8	5.2	6.7	6.0	5.9	5.6
DBAE72	65.0	9.5	8.1	8.8	9.7	5.1	6.6	5.9	5.9	5.5
EBAE72	64.7	9.5	8.1	8.7	9.7	5.0	6.5	5.9	5.8	5.5
ABAE73	66.5	9.5	8.1	8.8	9.8	5.5	6.8	6.2	6.1	5.7
BBAE73	66.4	9.5	8.1	8.8	9.8	5.4	6.8	6.2	6.1	5.6
CBAE73	66.3	9.5	8.1	8.8	9.8	5.4	6.8	6.3	6.1	5.6
DBAE73	66.0	9.5	8.1	8.8	9.8	5.3	6.8	6.3	6.0	5.5
EBAE73	65.6	9.5	8.1	8.7	9.7	5.2	6.7	6.2	5.9	5.5
ABAE81	63.9	9.4	8.1	8.7	9.8	5.0	6.1	5.5	5.7	5.6
BBAE81	63.9	9.4	8.1	8.7	9.8	5.0	6.1	5.5	5.7	5.6
CBAE81	63.8	9.4	8.1	8.7	9.8	5.0	6.0	5.5	5.7	5.6
DBAE81	63.7	9.5	8.1	8.7	9.8	5.0	6.1	5.5	5.6	5.5
EBAE81	63.4	9.4	8.2	8.6	9.7	5.0	6.0	5.5	5.6	5.4
ABAE82	65.3	9.5	8.2	8.8	9.9	5.3	6.4	5.8	5.9	5.7
BBAE82	65.2	9.5	8.2	8.8	9.9	5.2	6.3	5.8	5.9	5.7
CBAE82	65.1	9.5	8.2	8.8	9.9	5.2	6.4	5.8	5.9	5.7
DBAE82	64.9	9.5	8.2	8.7	9.8	5.3	6.3	5.8	5.8	5.6
EBAE82	64.2	9.4	8.2	8.6	9.6	5.3	6.2	5.8	5.7	5.5
ABAE83	66.0	9.5	8.2	8.8	9.9	5.4	6.4	6.0	6.0	5.8
BBAE83	66.0	9.5	8.2	8.8	9.9	5.4	6.4	6.0	6.0	5.8

Table 10-1. Average annual native fish physical habitat index for the Missouri River over the 96-year simulation period.

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Nebraska City Reach	St. Joseph Reach	Boonville Reach	Hermann Reach
CBAE83	66.0	9.5	8.2	8.8	9.9	5.4	6.5	6.0	6.0	5.8
DBAE83	65.9	9.5	8.2	8.7	9.9	5.5	6.5	6.0	6.0	5.7
EBAE83	64.8	9.4	8.1	8.6	9.6	5.5	6.4	6.1	5.8	5.4
ABAE91	64.6	9.5	8.1	8.8	9.8	5.0	6.4	5.7	5.7	5.6
BBAE91	64.5	9.5	8.1	8.8	9.8	5.0	6.4	5.7	5.7	5.5
CBAE91	64.4	9.5	8.1	8.8	9.8	5.0	6.4	5.7	5.7	5.5
DBAE91	64.2	9.5	8.1	8.7	9.8	5.0	6.3	5.6	5.7	5.5
EBAE91	64.0	9.5	8.1	8.7	9.7	4.9	6.3	5.7	5.6	5.4
ABAE92	66.1	9.5	8.1	8.9	9.8	5.4	6.8	6.0	5.9	5.7
BBAE92	65.9	9.5	8.1	8.9	9.8	5.3	6.8	6.0	5.9	5.6
CBAE92	65.9	9.5	8.1	8.8	9.8	5.3	6.8	6.0	5.9	5.6
DBAE92	65.5	9.5	8.1	8.8	9.8	5.2	6.7	6.0	5.9	5.5
EBAE92	65.2	9.5	8.1	8.8	9.7	5.1	6.6	6.0	5.8	5.5
ABAE93	67.0	9.5	8.1	8.9	9.8	5.6	6.9	6.3	6.1	5.7
BBAE93	66.8	9.5	8.1	8.9	9.8	5.5	6.9	6.3	6.1	5.7
CBAE93	66.7	9.5	8.1	8.8	9.8	5.5	6.9	6.3	6.1	5.7
DBAE93	66.4	9.5	8.1	8.8	9.8	5.4	6.8	6.3	6.0	5.6
EBAE93	65.9	9.5	8.1	8.7	9.7	5.3	6.7	6.2	6.0	5.5
EVQ2XX	70.8	9.8	8.9	8.7	9.9	6.6	7.3	7.1	6.7	5.9

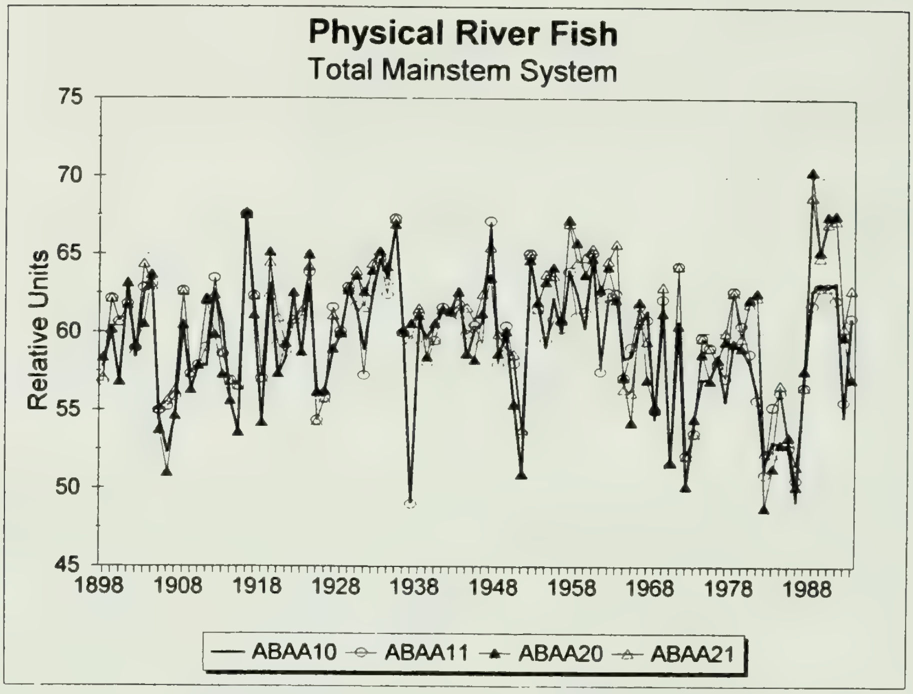

Figure 10-1. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

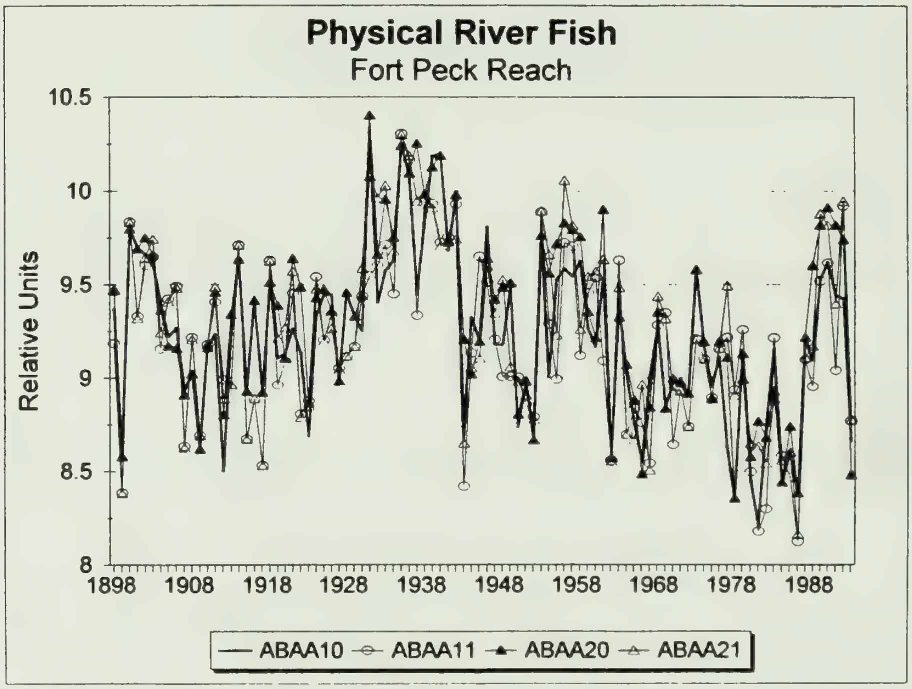

Figure 10-2. Average of annual indices of native fish physical habitat below Fort Peck Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

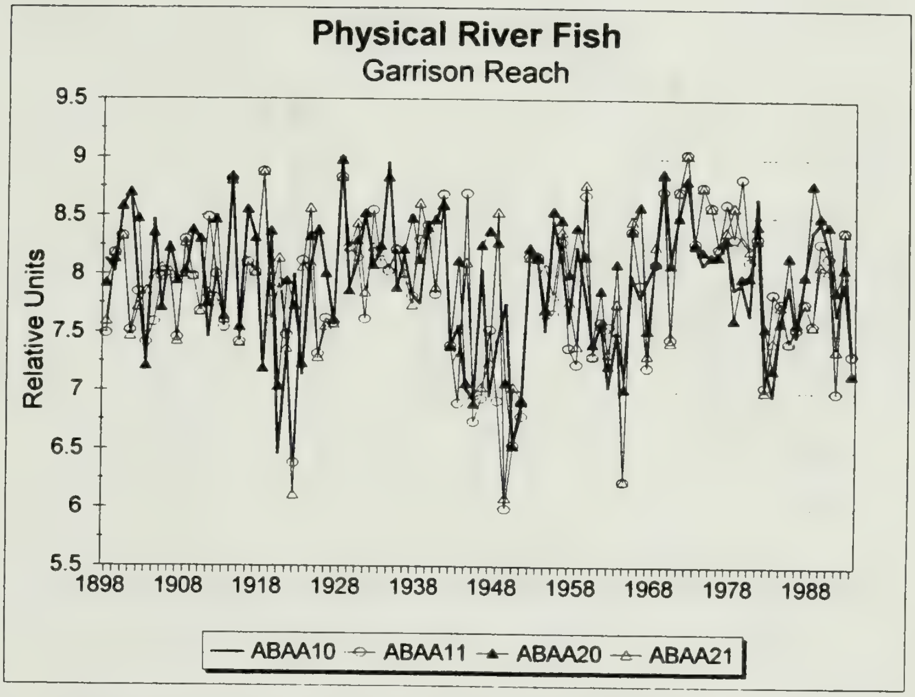

Figure 10-3. Average of annual indices of native fish physical habitat below Garrison Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

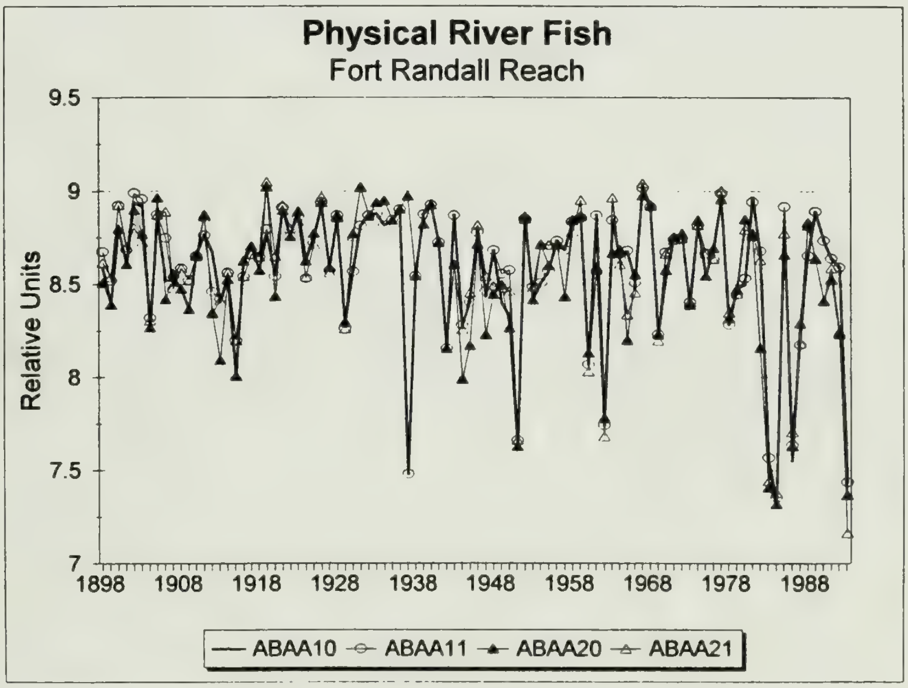

Figure 10-4. Average of annual indices of native fish physical habitat below Fort Randall Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

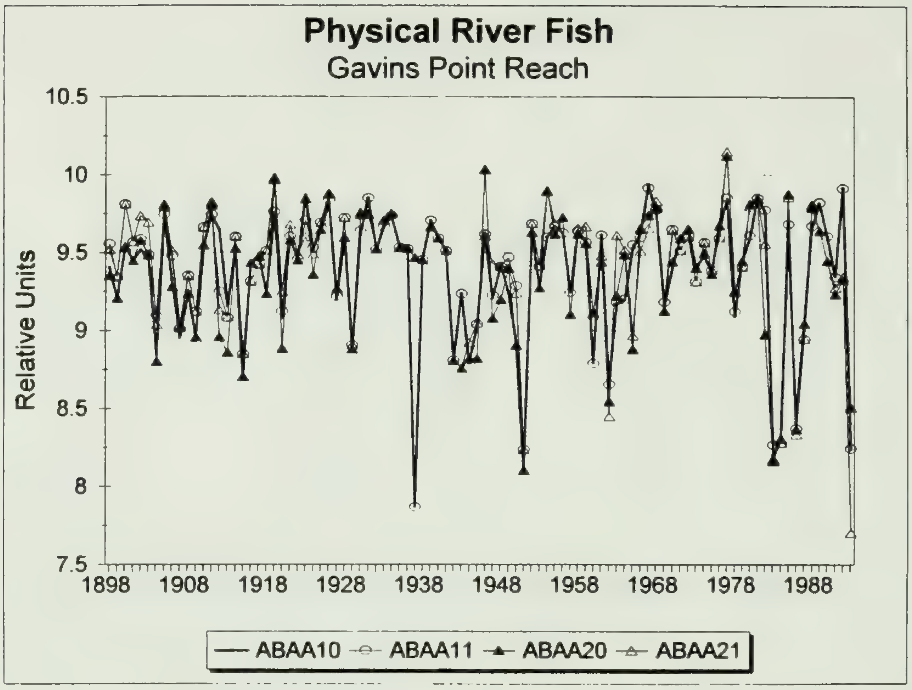

Figure 10-5. Average of annual indices of native fish physical habitat below Gavins Point Dam over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

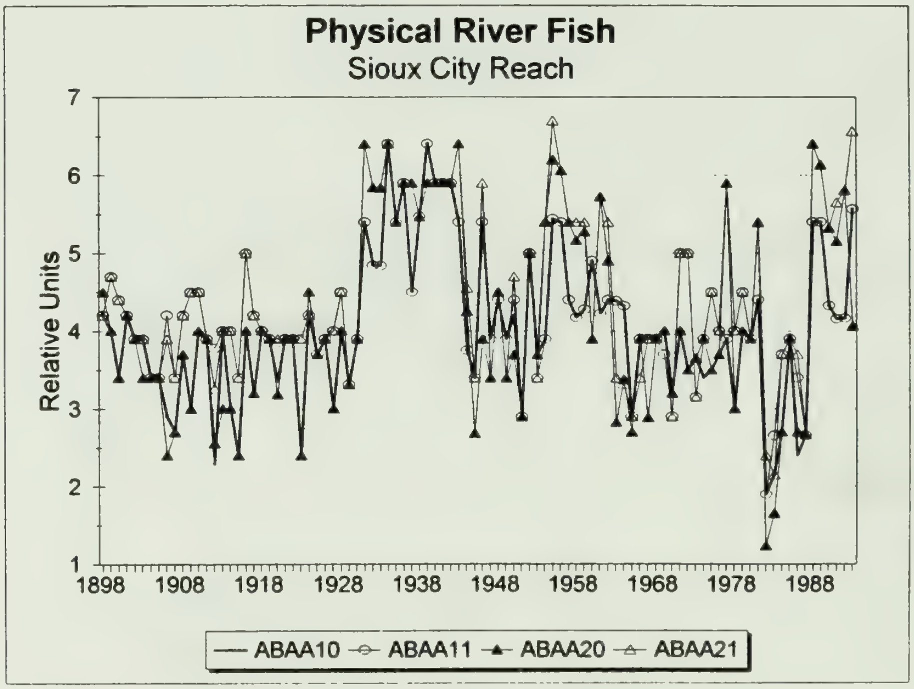

Figure 10-6. Average of annual indices of native fish physical habitat in the Sioux City reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

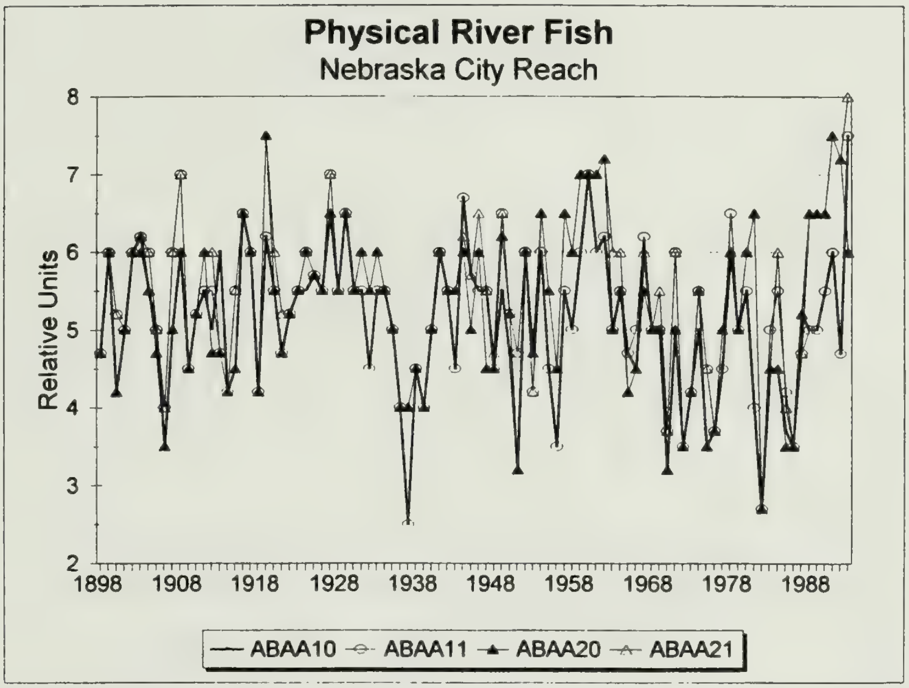

Figure 10-7. Average of annual indices of native fish physical habitat in the Nebraska City reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

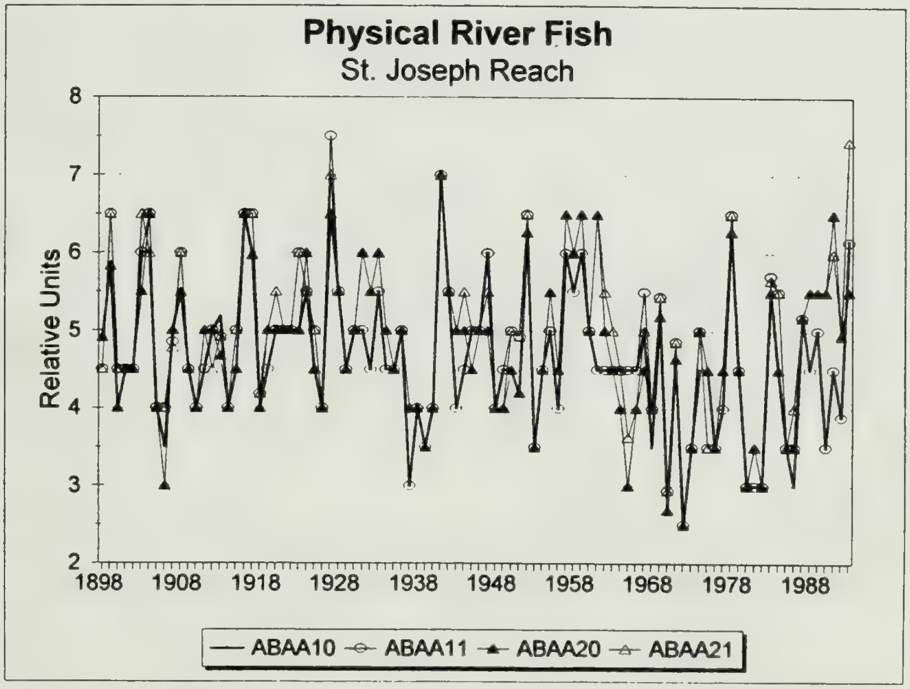

Figure 10-8. Average of annual indices of native fish physical habitat in the St. Joseph reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

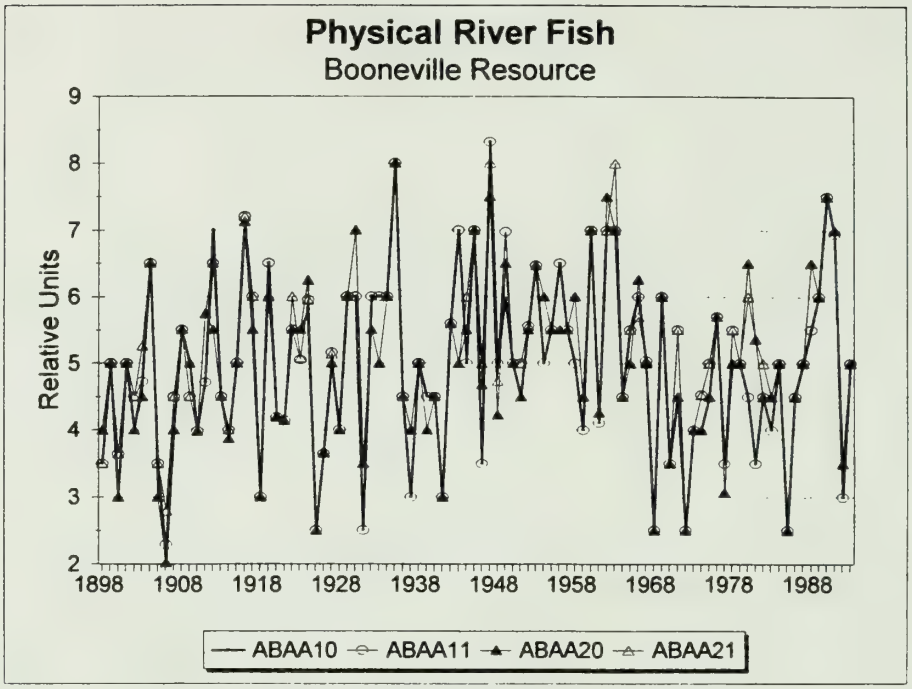

Figure 10-9. Average of annual indices of native fish physical habitat in the Boonville reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

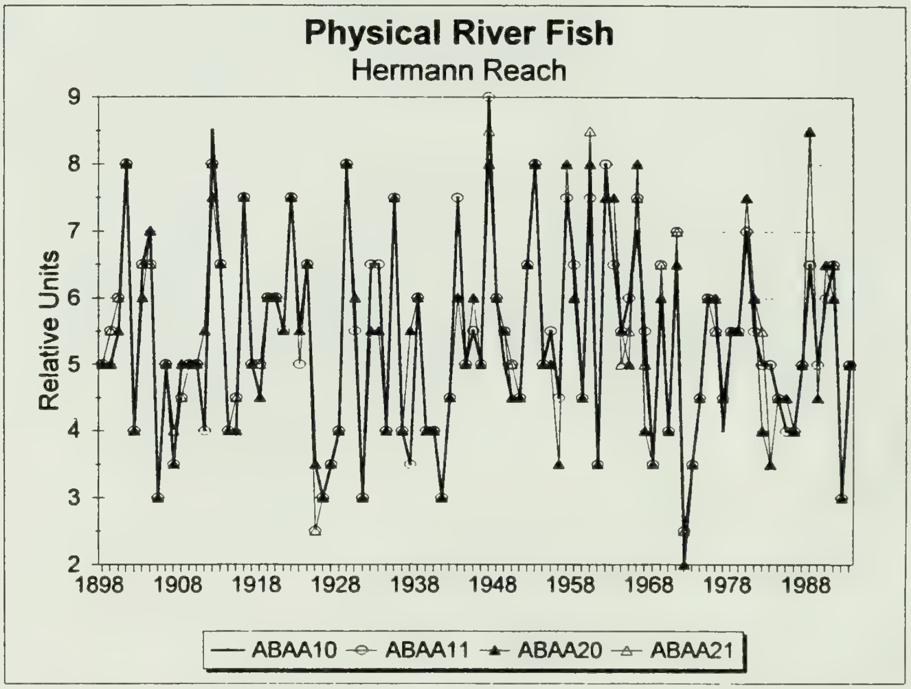

Figure 10-10. Average of annual indices of native fish physical habitat in the Hermann reach over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

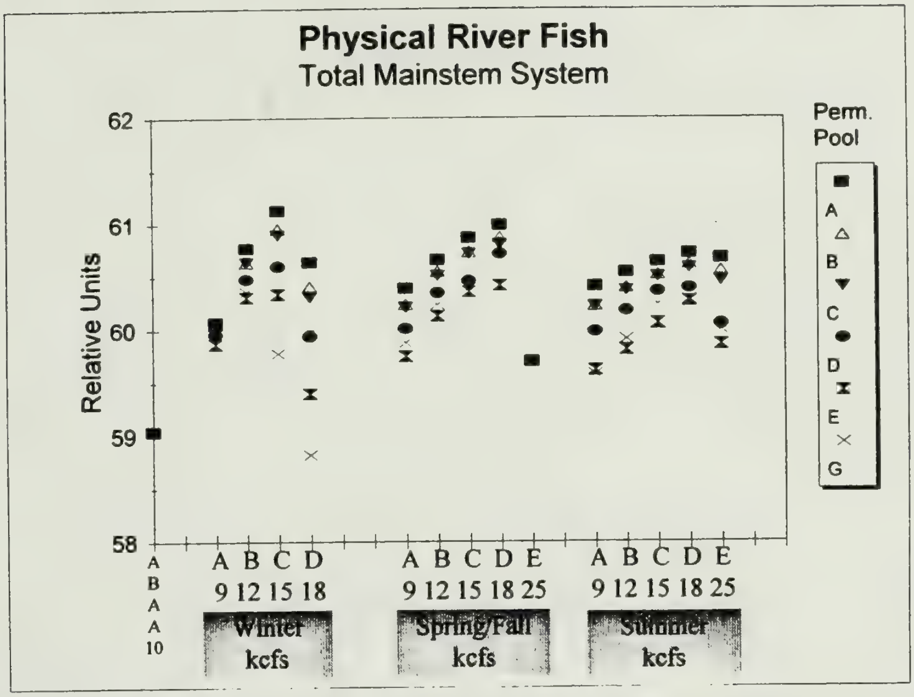

Figure 10-11. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period by nonnavigation service level.

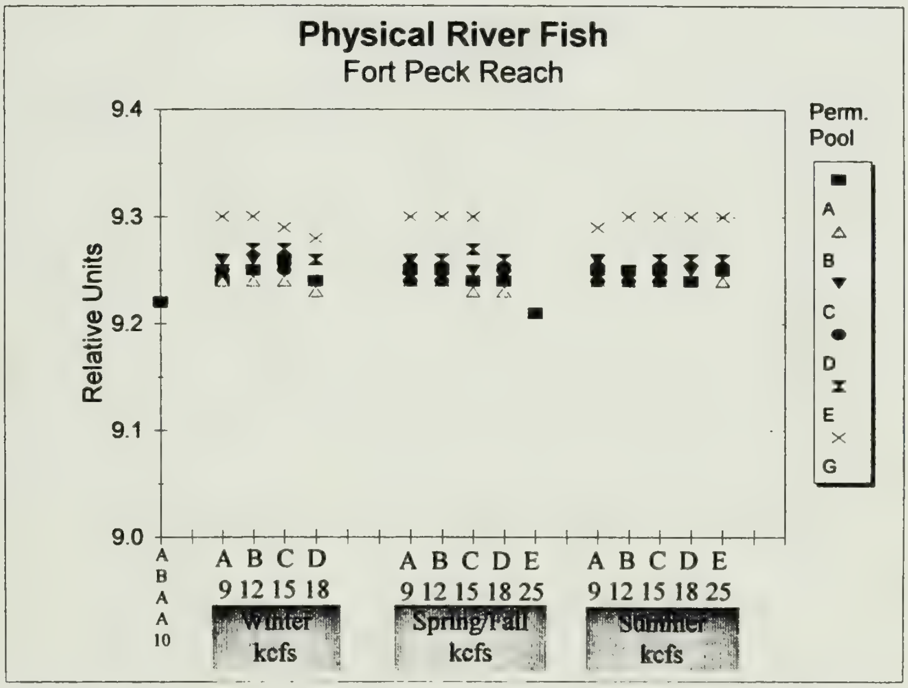

Figure 10-12. Average of annual indices of native fish physical habitat below Fort Peck Dam over the 96-year simulation period by nonnavigation service level.

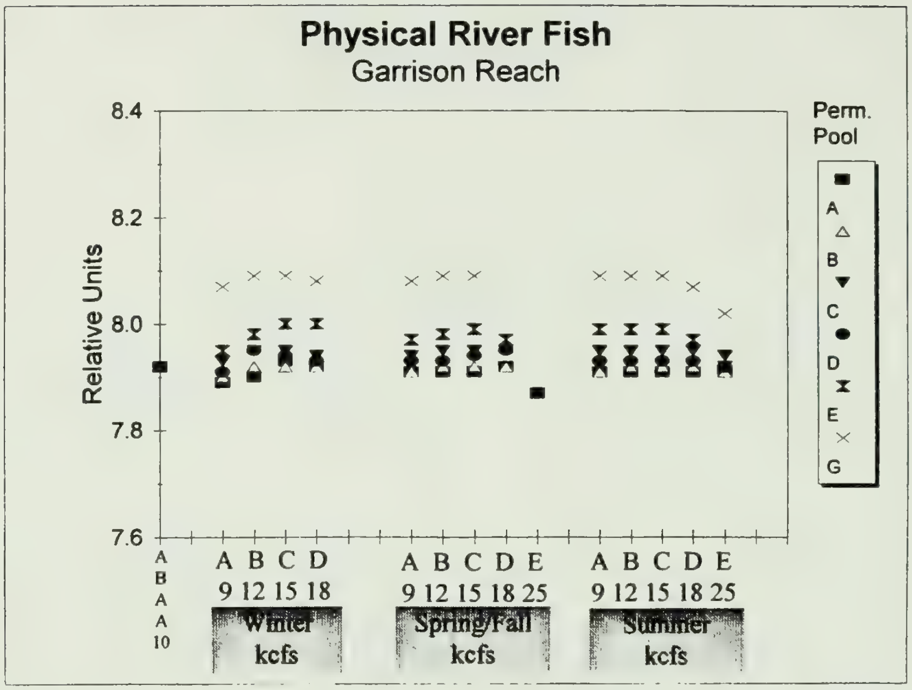

Figure 10-13. Average of annual indices of native fish physical habitat below Garrison Dam over the 96-year simulation period by nonnavigation service level.

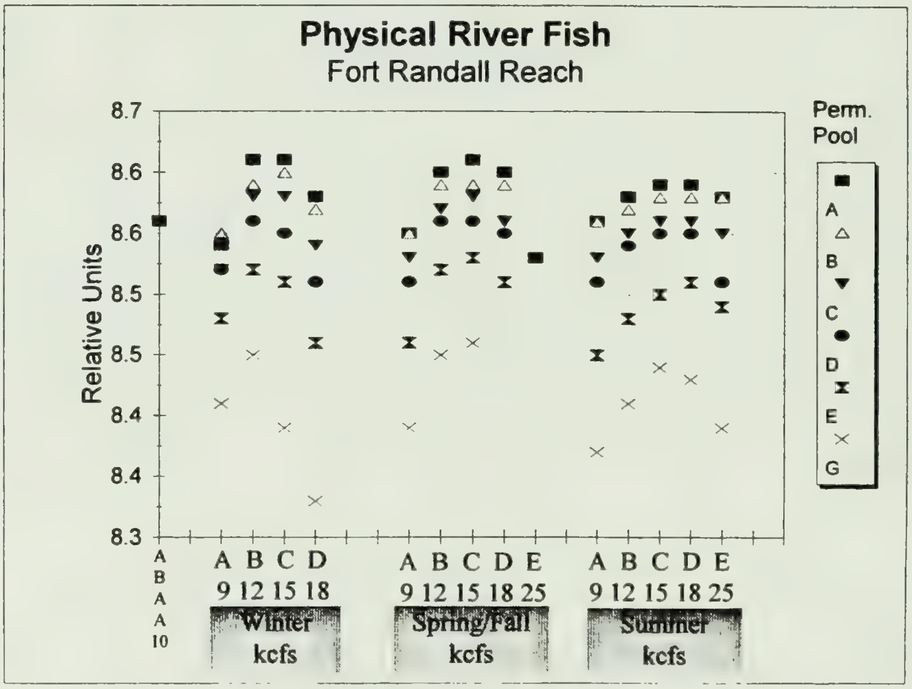

Figure 10-14. Average of annual indices of native fish physical habitat below Fort Randall Dam over the 96-year simulation period by nonnavigation service level.

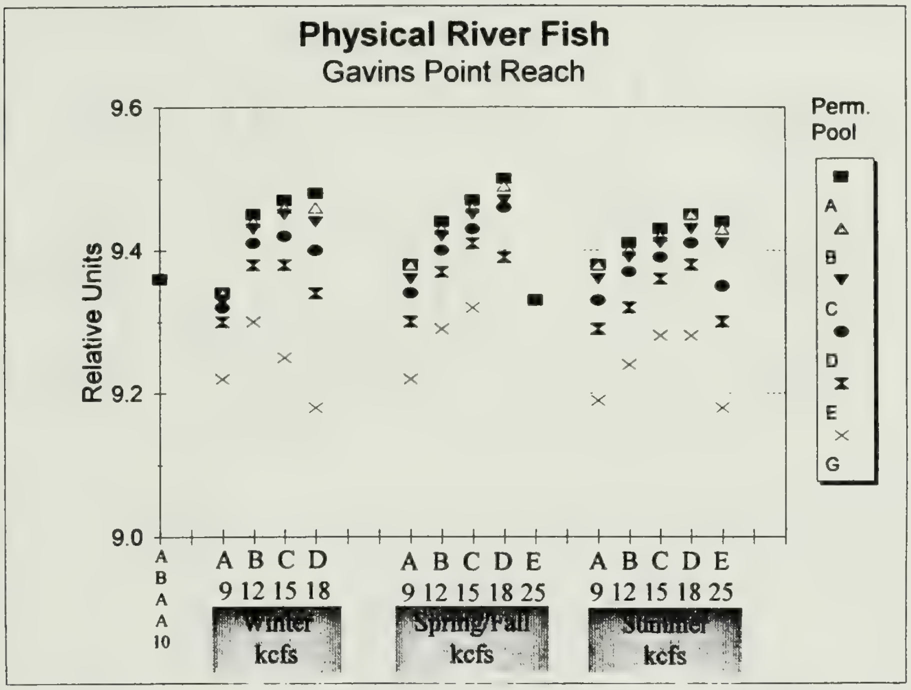

Figure 10-15. Average of annual indices of native fish physical habitat below Gavins Point Dam over the 96-year simulation period by nonnavigation service level.

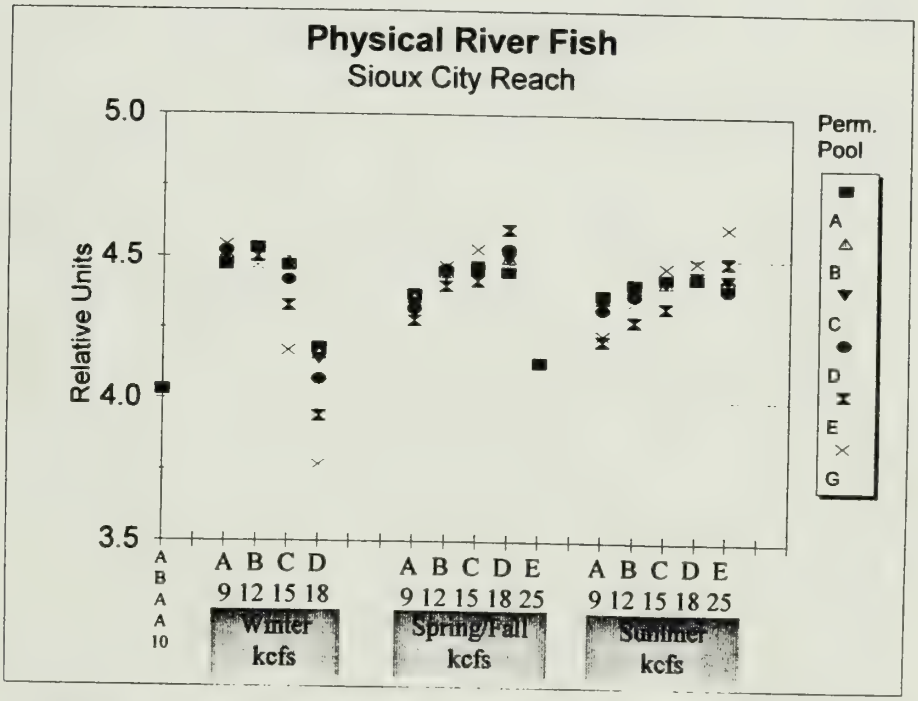

Figure 10-16. Average of annual indices of native fish physical habitat in the Sioux City reach over the 96-year simulation period by nonnavigation service level.

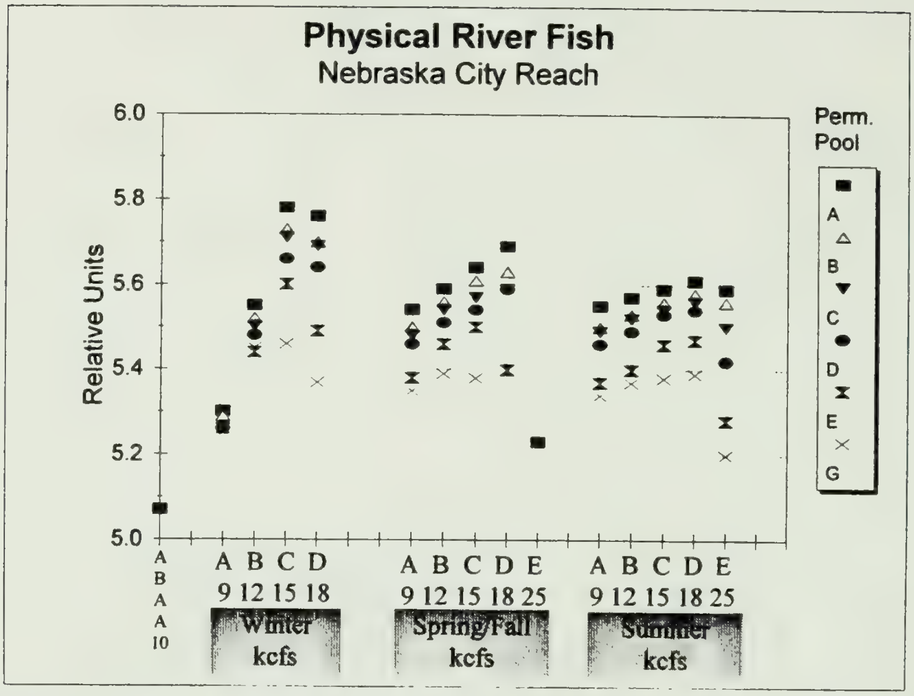

Figure 10-17. Average of annual indices of native fish physical habitat in the Nebraska City reach over the 96-year simulation period by nonnavigation service level.

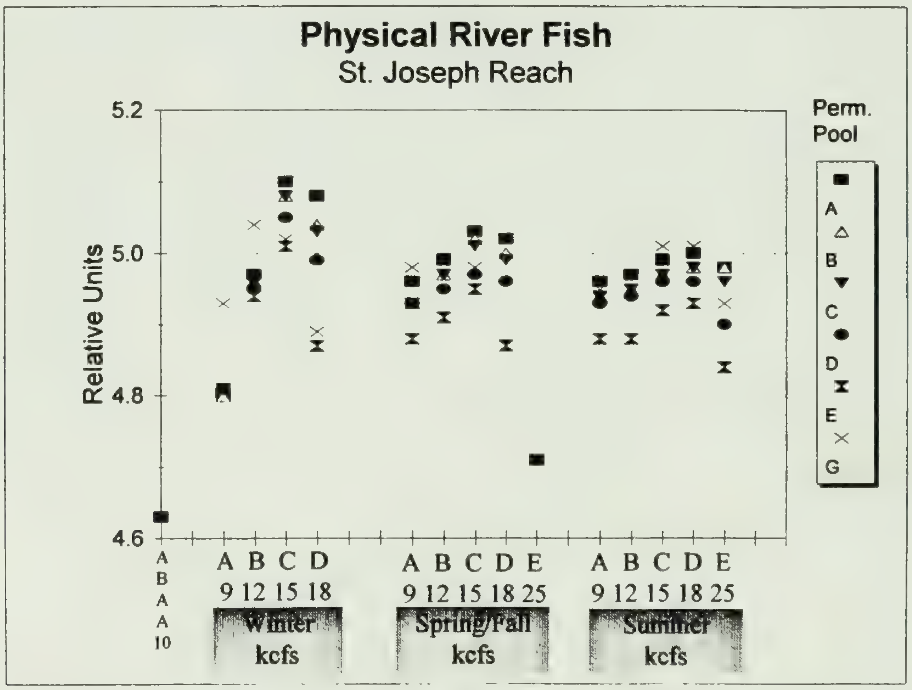

Figure 10-18. Average of annual indices of native fish physical habitat below St. Joseph reach over the 96-year simulation period by nonnavigation service level.

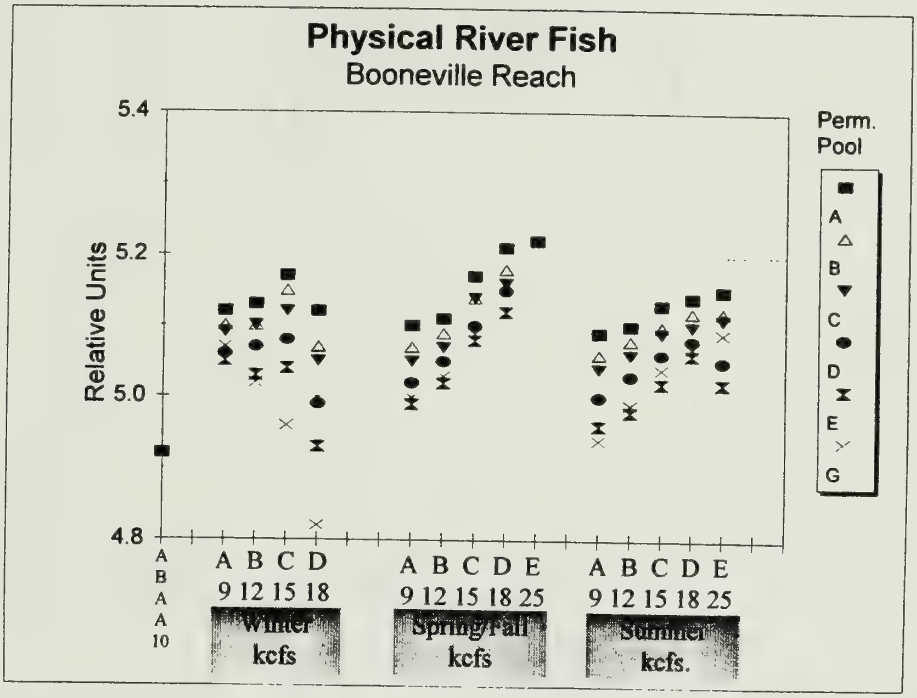

Figure 10-19. Average of annual indices of native fish physical habitat in the Boonville reach over the 96-year simulation period by nonnavigation service level.

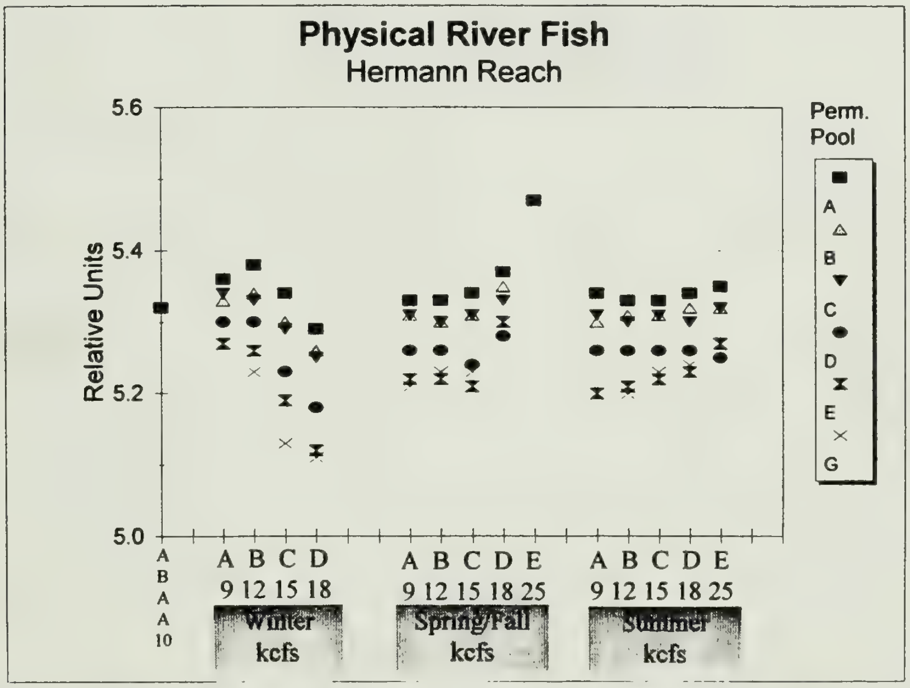

Figure 10-20. Average of annual indices of native fish physical habitat in the Hermann reach over the 96-year simulation period by nonnavigation service level.

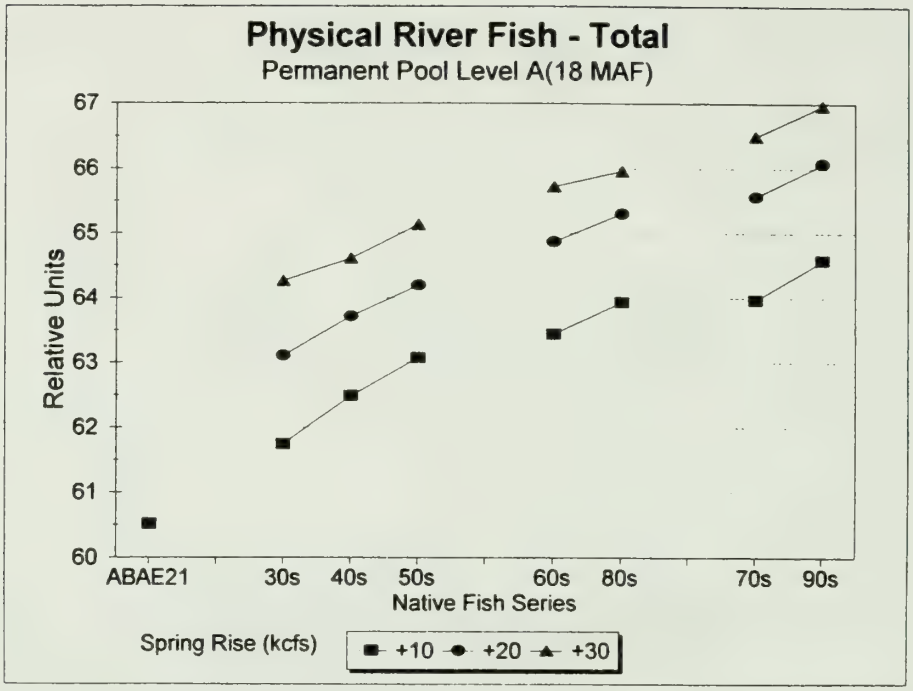

Figure 10-21. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

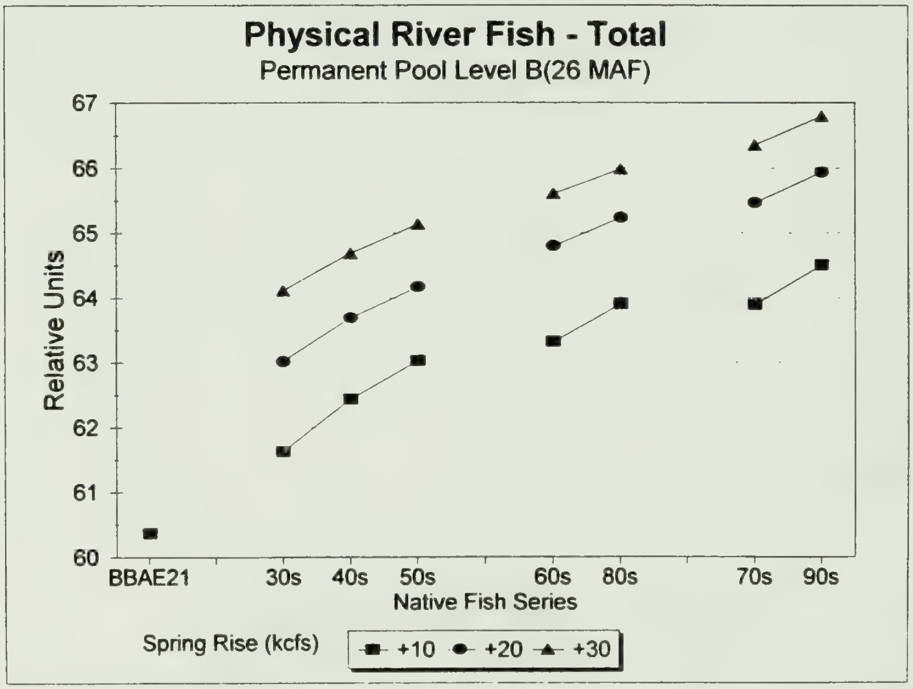

Figure 10-22. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

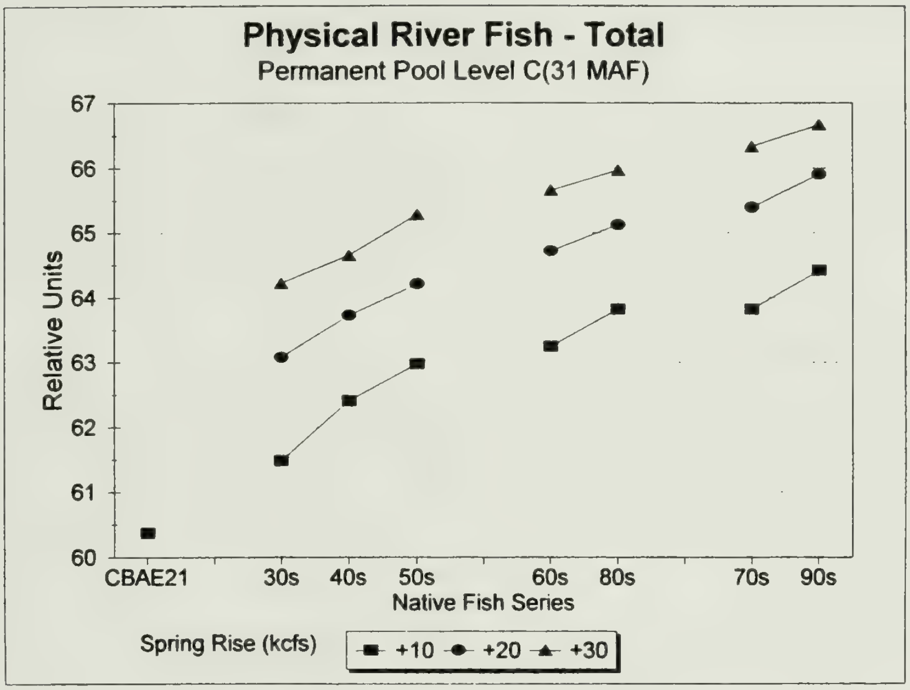

Figure 10-23. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

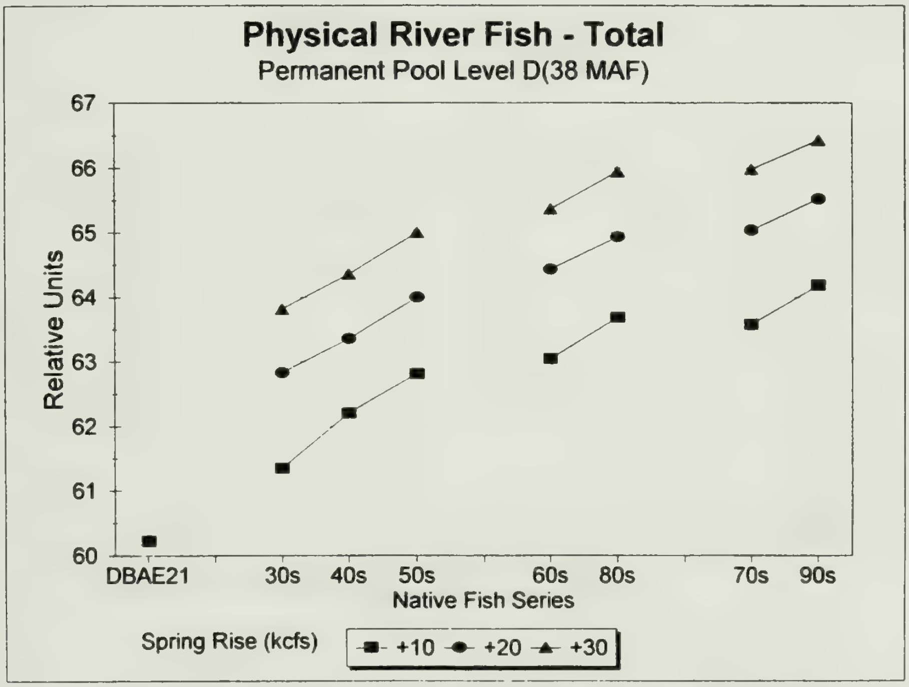

Figure 10-24. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

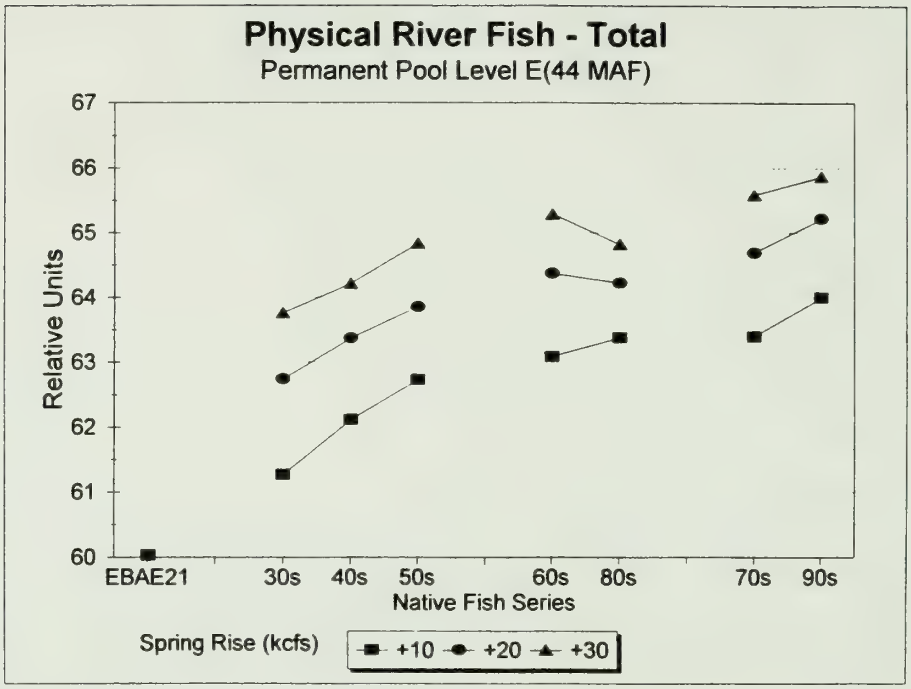

Figure 10-25. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

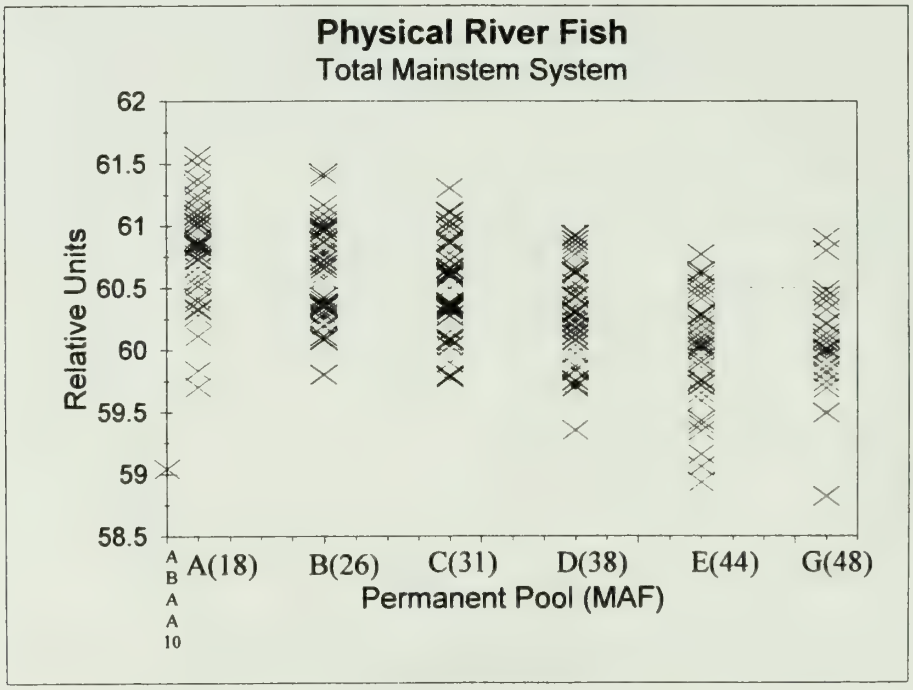

Figure 10-26. Average of annual indices of native fish physical habitat in riverine portions of the Mainstem System over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

11.0 FLOOD CONTROL

Flood control impacts are estimated for residential, commercial, and industrial buildings; agricultural resources; navigation disruptions; and river structures. The estimated benefits and costs are a function of the predicted depth of flooding; the location, value, and damage susceptibility of property; the season during which flooding occurs; and the length of navigation service interruption during floods.

Under the current Water Control Plan (alternative ABAA10), average annual flood control benefits are estimated at $44.4 million. The estimated flood control benefits of the other 382 alternatives range from a high of $44.7 million for alternative ADDE21 to a low of $37.1 million for alternative DBAE93 (Table 11-1). Thus, within the full range of alternatives that were studied, the alternative with the lowest flood control value is about 17 percent lower than the alternative with the highest benefit. Current operations fall within 1 percent of the highest flood control value.

The greatest flood control benefits occur in the Sioux City reach (Table 11-1). The St. Joseph, Omaha, and Nebraska City reaches, as well as the reach immediately downstream from Lake Oahe, also receive substantial flood control benefits. Because of the methodology used in the flood damage analysis, the benefits may be overstated downstream from Gavin. The analysis used the historical flow record that included years prior to construction of the dams on the Missouri River mainstem and some of its tributaries. In general, alternatives that would increase flooding, thereby decreasing flood control benefits, would affect all the downstream reaches in proportion to the property values at risk.

Changes in the way the Mainstem System is operated would affect flood damages on the river reaches. In general, all of the alternatives provide a high level of protection in all years except extreme flood years such as 1952 and 1993 (Figure 11-1). In summary:

- The modified navigation criteria would have a very slight negative effect on flood control benefits.
- Modified intrasystem regulation would have a very slight negative effect on flood control benefits.
- Changes to minimum nonnavigation service levels would affect flood control benefits only slightly. In general, higher flood control benefits are associated with higher minimum nonnavigation season flows.
- Increases in spring service levels for native fish would reduce the river's flood control benefits by increasing the frequency and magnitude of spring floods.
- Higher permanent pool levels would decrease the time to recover to normal operation following dry periods, so that flood control benefits would decrease during these normal operation periods as permanent pool levels rise.

11.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

The modified navigation and intrasystem regulation criteria would have a very slight negative impact on flood control benefits. Average annual flood control benefits with both the new navigation guide curves and intrasystem regulation (alternative ABAA21) would equal $43.8 million, a 1.3-percent decrease compared to the current Water Control Plan (alternative ABAA10) at $44.4 million (Table 11-1; Figure 11-1).

11.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVEL

Flood control benefits tend to increase very slightly with higher minimum nonnavigation service levels (Figure 11-2). Higher minimum nonnavigation season flows draw down the reservoirs, increasing the storage capacity available for future flood control and thereby increasing the time to refill the reservoirs and to return to normal operation. Since even the highest nonnavigation service levels are well below the flow rates provided to support navigation, they are not likely to contribute to flooding problems in the downstream reaches.

An exception to this pattern occurs at higher summer flows combined with the D and E permanent pool series (Figure 11-2). At the higher permanent pool levels, the benefits of increased storage capacity cannot be realized.

11.3 EFFECT OF NATIVE FISH SERIES

All alternatives that provide higher spring flows for native fish reduce flood control benefits compared to the current situation. Figure 11-3 illustrates the effects when combined with permanent pool level A. Comparable changes occur at other permanent pool levels. Flood control benefits drop as the spring flow becomes progressively higher (Figure 11-3).

At these different flow levels, flood control benefits are also affected by the degree to which flood control constraints are kept in place to control downstream flooding. Where the prescribed spring flow of 45, 55, or 65 kcfs is reduced if flooding is threatened (Figure 11-3), a reasonably high level of flood control benefits is retained. Those benefits drop slightly when a less aggressive flood control policy is followed (Figure 11-3), and drop dramatically when there are no flood control constraints (Figure 11-3). The alternative with the lowest flood control benefits, alternative DBAE93, would provide spring flows of 65 kcfs in all years, which would increase flooding and decrease flood control benefits in some years.

11.4 EFFECT OF PERMANENT POOL

In general, the value of flood control decreases as permanent pool level increases (Figure 11-4). The overall level of benefits is greatest for the A-pool series, and falls incrementally for the B-pool through G-pool series. This relationship reflects that following dry periods the alternative with higher permanent pools would return to normal sooner than an alternative with lower permanent pools. These normal operation flows would be greater than comparable flows from the alternative operating at below-normal pool levels. These flows would result in higher stages and damages from concurrent flood events. Only in extremely rare events would higher permanent pools affect flood damages because of inability to store flood water.

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ABAA10	44.42	0.55	1.41	5.16	0.47	0.35	14.04	4.25	5.93	7.99	0.60	2.47	1.18
ABAA11	44.13	0.54	1.33	5.16	0.48	0.35	14.01	4.25	5.92	7.94	0.52	2.47	1.19
ABAA20	44.20	0.54	1.41	5.16	0.47	0.35	14.07	4.24	5.89	7.94	0.61	2.41	1.10
AAAA21	43.85	0.54	1.30	5.16	0.48	0.35	13.96	4.25	5.94	7.85	0.56	2.38	1.09
AAAB21	43.85	0.54	1.30	5.16	0.48	0.35	13.96	4.25	5.94	7.85	0.56	2.38	1.09
AAAC21	43.85	0.54	1.30	5.16	0.48	0.35	13.96	4.25	5.94	7.85	0.56	2.38	1.09
AAAD21	43.85	0.54	1.30	5.16	0.48	0.35	13.96	4.25	5.94	7.85	0.56	2.38	1.09
AAAE21	43.85	0.54	1.30	5.16	0.48	0.35	13.96	4.25	5.94	7.85	0.56	2.38	1.09
AABB21	43.92	0.54	1.30	5.16	0.48	0.35	13.98	4.26	5.94	7.88	0.54	2.40	1.10
AABC21	43.92	0.54	1.30	5.16	0.48	0.35	13.98	4.26	5.94	7.88	0.54	2.40	1.10
AABD21	43.92	0.54	1.30	5.16	0.48	0.35	13.98	4.26	5.94	7.88	0.54	2.40	1.10
AABE21	43.92	0.54	1.30	5.16	0.48	0.35	13.98	4.26	5.94	7.88	0.54	2.40	1.10
AACC21	43.96	0.54	1.32	5.16	0.48	0.35	14.00	4.26	5.93	7.88	0.54	2.41	1.11
AACD21	43.96	0.54	1.32	5.16	0.48	0.35	14.00	4.26	5.93	7.88	0.54	2.41	1.11
AACE21	43.96	0.54	1.32	5.16	0.48	0.35	14.00	4.26	5.93	7.88	0.54	2.41	1.11
AADD21	43.92	0.54	1.30	5.16	0.48	0.35	13.97	4.27	5.95	7.89	0.56	2.34	1.10
AADE21	43.90	0.54	1.30	5.16	0.48	0.35	13.98	4.26	5.95	7.88	0.55	2.35	1.10
AAEE21	44.32	0.54	1.29	5.16	0.48	0.35	14.16	4.30	5.95	7.90	0.53	2.53	1.13
ABAA21	43.84	0.54	1.27	5.16	0.48	0.35	13.97	4.26	5.93	7.89	0.54	2.35	1.10
ABAB21	43.84	0.54	1.27	5.16	0.48	0.35	13.97	4.26	5.93	7.89	0.54	2.35	1.10
ABAC21	43.84	0.54	1.27	5.16	0.48	0.35	13.97	4.26	5.93	7.89	0.54	2.35	1.10
ABAD21	43.84	0.54	1.27	5.16	0.48	0.35	13.97	4.26	5.93	7.89	0.54	2.35	1.10
ABAE21	43.84	0.54	1.27	5.16	0.48	0.35	13.97	4.26	5.93	7.89	0.54	2.35	1.10
ABBB21	44.02	0.54	1.25	5.16	0.48	0.35	13.97	4.27	5.95	7.89	0.55	2.52	1.10
ABBC21	44.05	0.54	1.25	5.16	0.48	0.35	13.98	4.27	5.95	7.90	0.55	2.53	1.11
ABBD21	44.05	0.54	1.25	5.16	0.48	0.35	13.98	4.27	5.95	7.89	0.54	2.53	1.11
ABBE21	44.03	0.54	1.25	5.16	0.48	0.35	13.98	4.26	5.93	7.89	0.54	2.53	1.10
ABCC21	43.90	0.54	1.25	5.16	0.48	0.35	13.98	4.27	5.95	7.89	0.57	2.36	1.11
ABCD21	43.88	0.54	1.25	5.16	0.48	0.35	13.98	4.26	5.93	7.89	0.56	2.35	1.11
ABCE21	43.87	0.54	1.25	5.16	0.48	0.35	13.98	4.27	5.93	7.89	0.55	2.35	1.10
ABDD21	44.15	0.54	1.26	5.16	0.48	0.35	14.07	4.27	5.96	7.91	0.52	2.52	1.11
ABDE21	44.17	0.54	1.26	5.16	0.48	0.35	14.08	4.27	5.94	7.91	0.53	2.53	1.11

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ACAA21	44.11	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.94	7.91	0.56	2.54	1.11
ACAB21	44.11	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.94	7.91	0.56	2.54	1.11
ACAC21	44.06	0.54	1.26	5.16	0.48	0.35	13.97	4.27	5.96	7.90	0.54	2.52	1.11
ACAD21	44.10	0.54	1.26	5.16	0.48	0.35	13.98	4.27	5.95	7.90	0.57	2.53	1.11
ACAE21	44.10	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.94	7.91	0.56	2.54	1.11
ACBB21	44.11	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.94	7.90	0.57	2.54	1.12
ACBC21	44.13	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.94	7.91	0.57	2.54	1.12
ACBD21	44.27	0.54	1.26	5.16	0.48	0.35	14.13	4.27	5.95	7.92	0.56	2.54	1.12
ACBE21	44.24	0.54	1.26	5.16	0.48	0.35	14.12	4.27	5.95	7.92	0.54	2.54	1.12
ACCC21	44.15	0.54	1.26	5.16	0.48	0.35	13.99	4.27	5.95	7.92	0.57	2.54	1.12
ACCD21	44.13	0.54	1.26	5.16	0.48	0.35	14.00	4.27	5.95	7.92	0.55	2.54	1.12
ACCE21	44.28	0.54	1.26	5.16	0.48	0.35	14.12	4.28	5.97	7.93	0.54	2.54	1.12
ACDD21	44.29	0.54	1.26	5.16	0.48	0.35	14.10	4.28	5.96	7.93	0.57	2.54	1.13
ACDE21	44.30	0.54	1.26	5.16	0.48	0.35	14.10	4.28	5.96	7.93	0.58	2.55	1.12
ADAA21	44.28	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.95	7.95	0.61	2.55	1.13
ADAB21	44.28	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.95	7.95	0.61	2.55	1.13
ADAC21	44.29	0.54	1.27	5.16	0.48	0.35	13.99	4.28	5.97	7.95	0.62	2.54	1.13
ADAD21	44.28	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.95	7.95	0.61	2.55	1.14
ADAE21	44.42	0.54	1.27	5.16	0.48	0.35	14.13	4.28	5.98	7.96	0.59	2.55	1.13
ADBB21	44.29	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.96	7.95	0.62	2.55	1.14
ADBC21	44.30	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.96	7.95	0.62	2.55	1.14
ADBD21	44.36	0.54	1.27	5.16	0.48	0.35	14.10	4.27	5.98	7.95	0.59	2.52	1.13
ADBE21	44.42	0.54	1.27	5.16	0.48	0.35	14.13	4.28	5.97	7.96	0.59	2.55	1.13
ADCC21	44.21	0.54	1.27	5.16	0.48	0.35	14.00	4.28	5.96	7.96	0.49	2.55	1.15
ADCD21	44.32	0.54	1.27	5.16	0.48	0.35	14.01	4.28	5.96	7.96	0.61	2.55	1.15
ADCE21	44.35	0.54	1.27	5.16	0.48	0.35	14.13	4.28	5.97	7.97	0.49	2.55	1.15
ADDD21	44.38	0.54	1.30	5.16	0.48	0.35	14.11	4.28	5.97	7.98	0.48	2.55	1.17
ADDE21	44.70	0.54	1.32	5.16	0.48	0.35	14.31	4.36	5.98	7.98	0.49	2.56	1.18
BAAA21	43.73	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.56	2.27	1.09
BAAB21	43.73	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.56	2.27	1.09
BAAC21	43.73	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.56	2.27	1.09
BAAD21	43.73	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.56	2.27	1.09

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
BAAE21	43.73	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.56	2.27	1.09
BABB21	43.76	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.58	2.27	1.09
BABC21	43.76	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.58	2.27	1.09
BABD21	43.76	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.58	2.27	1.09
BABE21	43.75	0.54	1.33	5.16	0.48	0.35	13.97	4.24	5.91	7.83	0.58	2.27	1.09
BACC21	43.78	0.54	1.35	5.16	0.48	0.35	13.96	4.24	5.91	7.85	0.57	2.27	1.09
BACD21	43.80	0.54	1.35	5.16	0.48	0.35	13.98	4.24	5.91	7.85	0.57	2.27	1.09
BACE21	43.79	0.54	1.35	5.16	0.48	0.35	13.96	4.24	5.91	7.86	0.57	2.27	1.09
BADD21	43.82	0.54	1.34	5.16	0.48	0.35	13.98	4.24	5.92	7.85	0.59	2.27	1.10
BADE21	43.80	0.54	1.34	5.16	0.48	0.35	13.97	4.24	5.92	7.86	0.57	2.27	1.09
BBAA21	43.79	0.54	1.34	5.16	0.48	0.35	13.97	4.25	5.92	7.86	0.56	2.27	1.09
BBAB21	43.72	0.54	1.34	5.16	0.48	0.35	13.91	4.25	5.91	7.86	0.57	2.27	1.09
BBAC21	43.75	0.54	1.34	5.16	0.48	0.35	13.93	4.25	5.92	7.86	0.57	2.27	1.09
BBAD21	43.80	0.54	1.34	5.16	0.48	0.35	13.97	4.25	5.92	7.86	0.57	2.27	1.09
BBAE21	43.81	0.54	1.34	5.16	0.48	0.35	13.98	4.26	5.92	7.86	0.56	2.27	1.09
BBBB21	43.82	0.54	1.34	5.16	0.48	0.35	13.98	4.25	5.92	7.87	0.57	2.27	1.09
BBBC21	43.83	0.54	1.34	5.16	0.48	0.35	13.97	4.25	5.92	7.87	0.59	2.27	1.09
BBBD21	43.73	0.54	1.34	5.16	0.48	0.35	13.95	4.26	5.92	7.87	0.57	2.21	1.09
BBBE21	43.91	0.54	1.34	5.16	0.48	0.35	14.06	4.25	5.93	7.88	0.57	2.27	1.09
BBCC21	43.75	0.54	1.29	5.16	0.48	0.35	13.98	4.25	5.93	7.87	0.54	2.27	1.09
BBCD21	43.72	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.93	7.88	0.59	2.20	1.09
BBCE21	43.78	0.54	1.29	5.16	0.48	0.35	13.98	4.26	5.93	7.87	0.57	2.27	1.09
BBDD21	44.07	0.54	1.29	5.16	0.48	0.35	14.08	4.26	5.93	7.88	0.55	2.44	1.10
BBDE21	43.98	0.54	1.29	5.16	0.48	0.35	14.05	4.26	5.93	7.88	0.54	2.39	1.10
BCAA21	43.90	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.92	7.88	0.59	2.39	1.09
BCAB21	43.91	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.92	7.88	0.57	2.40	1.10
BCAC21	43.92	0.54	1.29	5.16	0.48	0.35	13.96	4.26	5.92	7.88	0.57	2.41	1.10
BCAD21	43.91	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.92	7.88	0.59	2.38	1.10
BCAE21	44.04	0.54	1.29	5.16	0.48	0.35	14.09	4.26	5.94	7.89	0.57	2.38	1.09
BCBB21	43.92	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.93	7.88	0.59	2.39	1.10
BCBC21	43.92	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.93	7.88	0.59	2.38	1.10
BCBD21	43.92	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.93	7.88	0.59	2.39	1.10

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
BCBE21	43.91	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.93	7.89	0.58	2.39	1.10
BCCC21	43.96	0.54	1.29	5.16	0.48	0.35	14.00	4.26	5.94	7.89	0.56	2.38	1.10
BCCD21	44.04	0.54	1.29	5.16	0.48	0.35	14.08	4.26	5.94	7.90	0.56	2.38	1.10
BCCE21	44.27	0.54	1.31	5.16	0.48	0.35	14.21	4.34	5.94	7.89	0.56	2.38	1.11
BCDD21	43.96	0.54	1.29	5.16	0.48	0.35	13.96	4.26	5.93	7.88	0.60	2.39	1.11
BCDE21	44.38	0.54	1.31	5.16	0.48	0.35	14.26	4.34	5.95	7.90	0.60	2.39	1.12
BDAA21	43.92	0.54	1.27	5.16	0.48	0.35	13.96	4.26	5.93	7.92	0.61	2.31	1.11
BDAB21	43.98	0.54	1.26	5.16	0.48	0.35	13.96	4.26	5.94	7.92	0.61	2.39	1.12
BDAC21	44.00	0.54	1.26	5.16	0.48	0.35	13.96	4.26	5.93	7.92	0.63	2.39	1.12
BDAD21	44.06	0.54	1.26	5.16	0.48	0.35	14.02	4.26	5.94	7.94	0.60	2.39	1.12
BDAE21	43.98	0.54	1.26	5.16	0.48	0.35	13.96	4.26	5.94	7.92	0.62	2.39	1.11
BDBB21	44.03	0.54	1.27	5.16	0.48	0.35	13.96	4.26	5.94	7.92	0.64	2.39	1.13
BDBC21	44.10	0.54	1.27	5.16	0.48	0.35	14.04	4.26	5.95	7.93	0.61	2.39	1.12
BDBD21	44.11	0.54	1.27	5.16	0.48	0.35	14.04	4.26	5.95	7.93	0.60	2.39	1.13
BDBE21	44.17	0.54	1.29	5.16	0.48	0.35	14.09	4.26	5.95	7.94	0.61	2.39	1.12
BDCC21	44.16	0.54	1.27	5.16	0.48	0.35	14.08	4.26	5.95	7.94	0.60	2.38	1.13
BDCD21	44.04	0.54	1.27	5.16	0.48	0.35	13.96	4.26	5.95	7.93	0.59	2.40	1.14
BDCE21	44.48	0.54	1.29	5.16	0.48	0.35	14.29	4.34	5.96	7.93	0.60	2.39	1.14
BDDD21	44.23	0.54	1.32	5.16	0.48	0.35	14.07	4.28	5.98	8.00	0.50	2.39	1.16
CAAA21	43.75	0.54	1.32	5.16	0.48	0.35	13.96	4.23	5.89	7.79	0.56	2.38	1.09
CAAB21	43.65	0.54	1.32	5.16	0.48	0.35	13.88	4.22	5.88	7.78	0.56	2.38	1.09
CAAC21	43.65	0.54	1.32	5.16	0.48	0.35	13.88	4.22	5.88	7.78	0.56	2.38	1.09
CAAD21	43.67	0.54	1.32	5.16	0.48	0.35	13.89	4.22	5.88	7.78	0.56	2.38	1.09
CAAE21	43.70	0.54	1.32	5.16	0.48	0.35	13.91	4.23	5.89	7.79	0.56	2.38	1.09
CABB21	43.70	0.54	1.34	5.16	0.48	0.35	13.78	4.26	5.94	7.86	0.59	2.34	1.07
CABC21	43.77	0.54	1.34	5.16	0.48	0.35	13.83	4.27	5.94	7.86	0.59	2.34	1.08
CABD21	43.80	0.54	1.34	5.16	0.48	0.35	13.86	4.24	5.94	7.85	0.57	2.38	1.09
CABE21	43.85	0.54	1.34	5.16	0.48	0.35	13.89	4.24	5.94	7.85	0.58	2.38	1.09
CACC21	43.90	0.54	1.35	5.16	0.48	0.35	13.92	4.25	5.94	7.86	0.57	2.38	1.10
CACD21	43.87	0.54	1.35	5.16	0.48	0.35	13.88	4.24	5.94	7.85	0.59	2.38	1.10
CACE21	43.95	0.54	1.35	5.16	0.48	0.35	13.96	4.25	5.95	7.86	0.58	2.38	1.09
CADD21	43.87	0.54	1.34	5.16	0.48	0.35	13.89	4.25	5.94	7.86	0.58	2.38	1.10

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
CADE21	43.99	0.54	1.34	5.16	0.48	0.35	14.01	4.25	5.96	7.87	0.56	2.38	1.09
CBAA21	43.90	0.54	1.34	5.16	0.48	0.35	13.92	4.26	5.94	7.87	0.58	2.38	1.09
CBAB21	43.78	0.54	1.34	5.16	0.48	0.35	13.83	4.27	5.95	7.87	0.59	2.34	1.08
CBAC21	43.89	0.54	1.34	5.16	0.48	0.35	13.89	4.26	5.94	7.86	0.59	2.38	1.09
CBAD21	43.89	0.54	1.34	5.16	0.48	0.35	13.91	4.26	5.95	7.86	0.57	2.38	1.09
CBAE21	43.91	0.54	1.34	5.16	0.48	0.35	13.92	4.26	5.95	7.87	0.58	2.38	1.09
CBBB21	43.91	0.54	1.34	5.16	0.48	0.35	13.92	4.26	5.95	7.87	0.57	2.38	1.09
CBBC21	43.98	0.54	1.34	5.16	0.48	0.35	13.98	4.26	5.95	7.87	0.59	2.38	1.09
CBBD21	43.93	0.54	1.34	5.16	0.48	0.35	13.92	4.26	5.95	7.87	0.59	2.38	1.09
CBBE21	44.01	0.54	1.34	5.16	0.48	0.35	14.01	4.25	5.96	7.88	0.57	2.38	1.09
CBCC21	44.05	0.54	1.30	5.16	0.48	0.35	13.91	4.26	5.95	7.88	0.56	2.56	1.10
CBCD21	44.09	0.54	1.30	5.16	0.48	0.35	13.92	4.26	5.95	7.87	0.59	2.56	1.10
CBCE21	44.19	0.54	1.32	5.16	0.48	0.35	14.02	4.26	5.96	7.88	0.56	2.56	1.09
CBDD21	43.88	0.54	1.29	5.16	0.48	0.35	13.81	4.26	5.96	7.89	0.56	2.51	1.08
CBDE21	44.36	0.54	1.27	5.16	0.48	0.35	14.15	4.35	5.97	7.91	0.56	2.51	1.11
CCAA21	44.10	0.54	1.27	5.16	0.48	0.35	13.93	4.27	5.95	7.90	0.59	2.56	1.10
CCAB21	44.04	0.54	1.27	5.16	0.48	0.35	13.94	4.26	5.95	7.90	0.59	2.50	1.09
CCAC21	44.05	0.54	1.27	5.16	0.48	0.35	13.95	4.26	5.95	7.90	0.59	2.50	1.09
CCAD21	44.07	0.54	1.27	5.16	0.48	0.35	13.96	4.27	5.95	7.90	0.59	2.49	1.10
CCAE21	44.21	0.54	1.27	5.16	0.48	0.35	14.04	4.27	5.96	7.91	0.57	2.56	1.10
CCBB21	44.05	0.54	1.27	5.16	0.48	0.35	13.94	4.26	5.95	7.90	0.59	2.50	1.10
CCBC21	44.11	0.54	1.27	5.16	0.48	0.35	13.93	4.27	5.96	7.91	0.57	2.56	1.11
CCBD21	44.06	0.54	1.27	5.16	0.48	0.35	13.95	4.26	5.96	7.90	0.60	2.50	1.10
CCBE21	44.21	0.54	1.29	5.16	0.48	0.35	14.03	4.27	5.96	7.91	0.57	2.56	1.10
CCCC21	44.00	0.54	1.27	5.16	0.48	0.35	13.91	4.27	5.96	7.89	0.56	2.51	1.09
CCCD21	44.01	0.54	1.29	5.16	0.48	0.35	13.88	4.26	5.96	7.89	0.59	2.51	1.08
CCCE21	44.44	0.54	1.29	5.16	0.48	0.35	14.19	4.35	5.97	7.92	0.56	2.51	1.11
CCDD21	44.25	0.54	1.29	5.16	0.48	0.35	13.98	4.27	5.98	7.94	0.60	2.56	1.11
CDAA21	44.16	0.54	1.27	5.16	0.48	0.35	13.95	4.26	5.96	7.93	0.63	2.50	1.12
CDAB21	44.16	0.54	1.27	5.16	0.48	0.35	13.95	4.26	5.96	7.93	0.63	2.50	1.12
CDAC21	44.16	0.54	1.27	5.16	0.48	0.35	13.96	4.26	5.96	7.93	0.64	2.50	1.12
CDAD21	44.06	0.54	1.27	5.16	0.48	0.35	13.90	4.26	5.97	7.92	0.61	2.50	1.10

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
CDAE21	44.24	0.54	1.29	5.16	0.48	0.35	14.02	4.27	5.97	7.95	0.61	2.50	1.11
CDBB21	44.23	0.54	1.27	5.16	0.48	0.35	14.00	4.27	5.97	7.95	0.61	2.50	1.12
CDBC21	44.12	0.54	1.27	5.16	0.48	0.35	13.93	4.26	5.97	7.93	0.61	2.50	1.11
CDBD21	44.19	0.54	1.29	5.16	0.48	0.35	13.95	4.26	5.97	7.96	0.61	2.50	1.11
CDBE21	44.56	0.54	1.29	5.16	0.48	0.35	14.21	4.35	5.98	7.95	0.61	2.50	1.13
CDCC21	44.28	0.54	1.31	5.16	0.48	0.35	14.00	4.27	5.98	7.96	0.60	2.50	1.13
CDCD21	44.22	0.54	1.29	5.16	0.48	0.35	13.94	4.26	5.98	7.99	0.61	2.50	1.11
CDDD21	44.40	0.54	1.31	5.16	0.48	0.35	14.01	4.28	6.01	8.02	0.61	2.50	1.14
DAAA21	43.40	0.54	1.32	5.16	0.48	0.35	13.73	4.23	5.90	7.78	0.57	2.27	1.08
DAAB21	43.46	0.54	1.32	5.16	0.48	0.35	13.78	4.23	5.90	7.79	0.57	2.27	1.08
DAAC21	43.32	0.54	1.32	5.16	0.48	0.35	13.67	4.22	5.90	7.78	0.57	2.27	1.07
DAAD21	43.45	0.54	1.32	5.16	0.48	0.35	13.76	4.22	5.90	7.81	0.57	2.27	1.07
DAAE21	43.46	0.54	1.32	5.16	0.48	0.35	13.78	4.23	5.90	7.79	0.58	2.27	1.07
DABB21	43.42	0.54	1.33	5.16	0.48	0.35	13.73	4.23	5.90	7.79	0.57	2.27	1.08
DABC21	43.58	0.54	1.33	5.16	0.48	0.35	13.84	4.24	5.91	7.82	0.57	2.27	1.08
DABD21	43.31	0.54	1.37	5.16	0.48	0.35	13.71	4.24	5.91	7.81	0.56	2.14	1.07
DABE21	43.24	0.54	1.33	5.16	0.48	0.35	13.58	4.21	5.91	7.78	0.58	2.27	1.05
DACC21	43.33	0.54	1.33	5.16	0.48	0.35	13.62	4.21	5.91	7.79	0.60	2.27	1.07
DACD21	43.33	0.54	1.33	5.16	0.48	0.35	13.62	4.21	5.91	7.79	0.60	2.27	1.07
DACE21	43.45	0.54	1.33	5.16	0.48	0.35	13.75	4.22	5.92	7.81	0.56	2.27	1.06
DADD21	43.54	0.54	1.33	5.16	0.48	0.35	13.79	4.22	5.92	7.81	0.59	2.27	1.07
DBAA21	43.35	0.54	1.35	5.16	0.48	0.35	13.62	4.21	5.91	7.80	0.59	2.27	1.07
DBAB21	43.48	0.54	1.35	5.16	0.48	0.35	13.72	4.23	5.91	7.81	0.60	2.27	1.07
DBAC21	43.43	0.54	1.35	5.16	0.48	0.35	13.69	4.22	5.91	7.81	0.58	2.27	1.07
DBAD21	43.41	0.54	1.35	5.16	0.48	0.35	13.66	4.22	5.91	7.80	0.60	2.27	1.07
DBAE21	43.33	0.54	1.35	5.16	0.48	0.35	13.62	4.21	5.91	7.80	0.58	2.27	1.05
DBBB21	43.43	0.54	1.35	5.16	0.48	0.35	13.72	4.22	5.91	7.77	0.58	2.27	1.07
DBBC21	43.44	0.54	1.35	5.16	0.48	0.35	13.68	4.22	5.91	7.81	0.60	2.27	1.07
DBBD21	43.40	0.54	1.35	5.16	0.48	0.35	13.65	4.23	5.92	7.81	0.58	2.27	1.07
DBBE21	43.49	0.52	1.33	5.16	0.48	0.35	13.78	4.23	5.92	7.82	0.57	2.27	1.06
DBCC21	43.41	0.54	1.33	5.16	0.48	0.35	13.66	4.22	5.92	7.83	0.57	2.27	1.07
DBCD21	43.64	0.54	1.33	5.16	0.48	0.35	13.83	4.23	5.93	7.85	0.60	2.27	1.07

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DBDD21	43.55	0.52	1.33	5.16	0.48	0.35	13.74	4.23	5.93	7.88	0.60	2.27	1.07
DCAA21	43.40	0.54	1.30	5.16	0.48	0.35	13.69	4.24	5.92	7.86	0.58	2.20	1.07
DCAB21	43.46	0.54	1.30	5.16	0.48	0.35	13.72	4.24	5.92	7.88	0.58	2.20	1.07
DCAC21	43.43	0.54	1.30	5.16	0.48	0.35	13.70	4.24	5.92	7.86	0.60	2.20	1.07
DCAD21	43.31	0.54	1.30	5.16	0.48	0.35	13.62	4.23	5.92	7.86	0.58	2.20	1.06
DCAE21	43.36	0.51	1.29	5.16	0.48	0.35	13.74	4.23	5.93	7.85	0.57	2.21	1.05
DCBB21	43.56	0.54	1.29	5.16	0.48	0.35	13.67	4.24	5.92	7.87	0.58	2.38	1.07
DCBC21	43.50	0.54	1.29	5.16	0.48	0.35	13.62	4.23	5.93	7.87	0.58	2.38	1.07
DCBD21	43.65	0.54	1.29	5.16	0.48	0.35	13.72	4.24	5.92	7.89	0.60	2.38	1.07
DCBE21	43.62	0.54	1.36	5.16	0.48	0.35	13.84	4.25	5.93	7.90	0.55	2.20	1.06
DCCC21	43.77	0.54	1.29	5.16	0.48	0.35	13.80	4.24	5.94	7.89	0.61	2.38	1.08
DCCD21	43.56	0.51	1.32	5.16	0.48	0.35	13.73	4.25	5.96	7.92	0.61	2.21	1.07
DCDD21	43.88	0.54	1.38	5.16	0.48	0.35	13.78	4.26	5.98	7.96	0.61	2.30	1.08
DDAA21	43.58	0.54	1.29	5.16	0.48	0.35	13.60	4.22	5.93	7.90	0.65	2.39	1.09
DDAB21	43.25	0.54	1.32	5.16	0.48	0.35	13.49	4.20	5.93	7.89	0.61	2.21	1.07
DDAC21	43.63	0.54	1.29	5.16	0.48	0.35	13.62	4.23	5.94	7.90	0.63	2.39	1.09
DDAD21	43.77	0.52	1.29	5.16	0.48	0.35	13.76	4.24	5.95	7.91	0.64	2.39	1.09
DDAE21	43.72	0.54	1.37	5.16	0.48	0.35	13.84	4.25	5.93	7.93	0.59	2.21	1.07
DDBB21	43.73	0.54	1.29	5.16	0.48	0.35	13.75	4.23	5.94	7.91	0.60	2.38	1.09
DDBC21	43.76	0.52	1.29	5.16	0.48	0.35	13.76	4.24	5.95	7.92	0.62	2.39	1.09
DDBD21	43.97	0.54	1.29	5.16	0.48	0.35	13.83	4.24	5.94	7.92	0.64	2.49	1.09
DDCC21	43.81	0.51	1.29	5.16	0.48	0.35	13.73	4.24	5.95	7.93	0.60	2.49	1.09
DDCD21	43.92	0.51	1.39	5.16	0.48	0.35	13.76	4.25	5.98	7.99	0.65	2.31	1.09
EAAA21	43.07	0.54	1.36	5.16	0.48	0.35	13.51	4.15	5.85	7.64	0.58	2.38	1.07
EAAB21	43.12	0.54	1.36	5.16	0.48	0.35	13.53	4.16	5.85	7.66	0.58	2.38	1.07
EAAC21	43.25	0.52	1.34	5.16	0.48	0.35	13.47	4.17	5.93	7.80	0.58	2.38	1.07
EAAD21	43.14	0.51	1.34	5.16	0.48	0.35	13.46	4.16	5.90	7.76	0.58	2.38	1.07
EAAE21	43.12	0.51	1.34	5.16	0.48	0.35	13.58	4.17	5.83	7.68	0.57	2.38	1.05
EABB21	42.89	0.52	1.36	5.16	0.48	0.35	13.46	4.13	5.84	7.63	0.51	2.38	1.07
EABC21	43.19	0.51	1.34	5.16	0.48	0.35	13.46	4.17	5.93	7.81	0.53	2.38	1.07
EABD21	42.71	0.52	1.36	5.16	0.48	0.35	13.52	4.12	5.79	7.48	0.60	2.28	1.06
EABE21	43.63	0.52	1.34	5.16	0.48	0.35	13.80	4.22	5.93	7.81	0.57	2.38	1.06

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
EACC21	43.24	0.51	1.35	5.16	0.48	0.35	13.48	4.17	5.94	7.81	0.55	2.38	1.07
EACD21	43.34	0.54	1.37	5.16	0.48	0.35	13.74	4.17	5.83	7.66	0.59	2.38	1.06
EADD21	43.62	0.51	1.37	5.16	0.48	0.35	13.71	4.21	5.95	7.84	0.59	2.38	1.07
EBAA21	42.95	0.52	1.37	5.16	0.48	0.35	13.55	4.15	5.82	7.53	0.59	2.38	1.06
EBAB21	42.81	0.53	1.37	5.16	0.48	0.35	13.49	4.13	5.83	7.53	0.52	2.38	1.06
EBAC21	43.50	0.52	1.37	5.16	0.48	0.35	13.56	4.19	5.93	7.80	0.59	2.48	1.07
EBAD21	43.35	0.52	1.37	5.16	0.48	0.35	13.49	4.18	5.94	7.82	0.59	2.38	1.07
EBAE21	43.47	0.52	1.37	5.16	0.48	0.35	13.83	4.20	5.85	7.71	0.57	2.38	1.06
EBBB21	43.55	0.51	1.37	5.16	0.48	0.35	13.56	4.19	5.95	7.83	0.58	2.48	1.07
EBBC21	43.42	0.51	1.37	5.16	0.48	0.35	13.55	4.19	5.93	7.83	0.60	2.38	1.06
EBBD21	43.49	0.51	1.37	5.16	0.48	0.35	13.76	4.19	5.88	7.76	0.60	2.38	1.05
EBCC21	43.41	0.50	1.37	5.16	0.48	0.35	13.48	4.17	5.93	7.81	0.61	2.48	1.06
EBCD21	43.67	0.51	1.37	5.16	0.48	0.35	13.74	4.22	5.95	7.85	0.60	2.38	1.06
ECAA21	43.29	0.51	1.37	5.16	0.48	0.35	13.60	4.22	5.94	7.84	0.58	2.19	1.06
ECAB21	43.45	0.51	1.37	5.16	0.48	0.35	13.57	4.21	5.94	7.84	0.58	2.38	1.06
ECAC21	43.83	0.52	1.37	5.16	0.48	0.35	13.56	4.24	6.03	7.96	0.61	2.48	1.07
ECAD21	43.75	0.54	1.37	5.16	0.48	0.35	13.51	4.23	6.03	7.94	0.60	2.48	1.06
ECBB21	43.48	0.51	1.37	5.16	0.48	0.35	13.56	4.20	5.95	7.85	0.60	2.38	1.06
ECBC21	43.82	0.54	1.37	5.16	0.48	0.35	13.51	4.24	6.05	7.97	0.61	2.48	1.07
ECBD21	43.99	0.51	1.37	5.16	0.48	0.35	13.75	4.25	6.02	7.93	0.61	2.48	1.07
ECCC21	44.25	0.51	1.41	5.16	0.48	0.35	13.81	4.28	6.05	8.01	0.62	2.48	1.08
ECCD21	44.12	0.50	1.41	5.16	0.48	0.35	13.72	4.26	6.06	8.01	0.62	2.48	1.07
EDAA21	43.80	0.51	1.41	5.16	0.48	0.35	13.58	4.26	6.02	8.00	0.61	2.32	1.08
EDAB21	43.76	0.51	1.41	5.16	0.48	0.35	13.54	4.24	6.04	8.01	0.63	2.32	1.07
EDAC21	43.82	0.51	1.41	5.16	0.48	0.35	13.55	4.25	6.00	7.96	0.66	2.42	1.07
EDBB21	43.84	0.51	1.41	5.16	0.48	0.35	13.54	4.25	6.02	7.98	0.64	2.42	1.08
EDBC21	44.12	0.51	1.41	5.16	0.48	0.35	13.74	4.27	6.06	8.04	0.61	2.42	1.08
EDBD21	44.12	0.50	1.41	5.16	0.48	0.35	13.71	4.27	6.07	8.03	0.66	2.42	1.07
EDCC21	88.29	1.00	2.78	10.31	0.96	0.71	27.39	8.53	12.14	16.13	1.33	4.84	2.17
GAAA21	43.08	0.51	1.36	5.16	0.47	0.35	13.42	4.16	5.92	7.85	0.56	2.37	0.94
GAAB21	43.15	0.51	1.37	5.16	0.46	0.35	13.43	4.18	5.97	7.94	0.55	2.28	0.94
GAAC21	43.17	0.51	1.37	5.16	0.46	0.35	13.43	4.18	5.97	7.94	0.58	2.28	0.94

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
GAAD21	43.29	0.51	1.32	5.16	0.47	0.35	13.37	4.17	5.99	7.95	0.59	2.47	0.94
GAAE21	43.03	0.50	1.35	5.16	0.47	0.35	13.37	4.15	5.93	7.88	0.58	2.37	0.93
GABB21	42.89	0.52	1.38	5.16	0.47	0.35	13.70	4.19	5.76	7.80	0.53	2.07	0.95
GABC21	43.09	0.52	1.38	5.16	0.47	0.35	13.71	4.21	5.82	7.82	0.52	2.17	0.96
GABD21	42.56	0.52	1.36	5.16	0.47	0.35	13.71	4.13	5.71	7.51	0.53	2.16	0.95
GACC21	42.80	0.52	1.36	5.16	0.47	0.35	13.71	4.15	5.76	7.66	0.53	2.17	0.96
GACD21	43.26	0.51	1.36	5.16	0.47	0.35	13.65	4.19	5.91	7.83	0.54	2.36	0.94
GBAA21	42.51	0.51	1.33	5.16	0.47	0.35	13.46	4.16	5.69	7.77	0.58	2.07	0.96
GBAB21	42.57	0.52	1.35	5.16	0.47	0.35	13.46	4.16	5.73	7.82	0.54	2.07	0.96
GBAC21	42.86	0.52	1.35	5.16	0.47	0.35	13.46	4.18	5.83	7.88	0.52	2.17	0.96
GBAD21	42.54	0.52	1.36	5.16	0.47	0.35	13.47	4.12	5.72	7.70	0.53	2.17	0.96
GBBB21	42.92	0.52	1.37	5.16	0.46	0.35	13.73	4.18	5.71	7.78	0.54	2.17	0.95
GBBC21	42.72	0.52	1.35	5.16	0.47	0.35	13.47	4.15	5.79	7.79	0.53	2.17	0.97
GBBD21	43.25	0.52	1.37	5.16	0.47	0.35	13.46	4.19	5.92	7.93	0.55	2.37	0.97
GBCC21	42.97	0.51	1.33	5.16	0.46	0.35	13.68	4.15	5.78	7.68	0.56	2.37	0.95
GCAA21	42.79	0.52	1.38	5.16	0.46	0.35	13.74	4.17	5.60	7.74	0.55	2.17	0.96
GCAB21	43.21	0.52	1.36	5.16	0.46	0.35	13.75	4.24	5.80	7.91	0.53	2.18	0.96
GCAC21	42.93	0.52	1.34	5.16	0.46	0.35	13.75	4.16	5.67	7.65	0.55	2.37	0.95
GCAD21	42.78	0.51	1.33	5.16	0.46	0.35	13.62	4.17	5.72	7.69	0.57	2.25	0.94
GCBB21	42.95	0.52	1.33	5.16	0.46	0.35	13.75	4.17	5.68	7.66	0.55	2.37	0.96
GDAA21	43.50	0.52	1.33	5.16	0.46	0.35	13.77	4.25	5.78	7.97	0.68	2.18	1.05
ABAE31	43.51	0.52	1.31	5.16	0.48	0.36	13.55	4.18	5.90	7.83	0.54	2.59	1.14
BBAE31	43.14	0.52	1.29	5.16	0.48	0.36	13.48	4.17	5.92	7.82	0.54	2.32	1.13
CBAE31	43.36	0.52	1.31	5.16	0.48	0.36	13.48	4.17	5.92	7.82	0.56	2.49	1.13
DBAE31	42.71	0.52	1.31	5.16	0.48	0.36	13.15	4.14	5.92	7.80	0.56	2.29	1.07
EBAE31	42.38	0.49	1.31	5.16	0.48	0.36	13.27	4.10	5.81	7.63	0.49	2.29	1.04
ABAE32	42.77	0.54	1.26	5.16	0.48	0.36	13.02	4.09	5.86	7.89	0.46	2.52	1.14
BBAE32	42.70	0.54	1.26	5.16	0.48	0.36	12.97	4.09	5.88	7.87	0.49	2.49	1.13
CBAE32	42.63	0.54	1.26	5.16	0.48	0.36	12.94	4.09	5.88	7.86	0.49	2.47	1.12
DBAE32	41.99	0.54	1.25	5.16	0.48	0.36	12.50	4.04	5.88	7.85	0.49	2.41	1.03
EBAE32	41.53	0.49	1.23	5.16	0.48	0.36	12.55	3.98	5.76	7.66	0.39	2.47	1.01
ABAE33	42.04	0.54	1.34	5.16	0.45	0.35	12.73	4.01	5.82	7.64	0.39	2.51	1.08

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
BBAE33	41.93	0.54	1.34	5.16	0.45	0.35	12.70	4.02	5.84	7.62	0.37	2.49	1.05
CBAE33	41.68	0.54	1.34	5.16	0.45	0.35	12.53	3.96	5.84	7.64	0.40	2.45	1.02
DBAE33	41.36	0.54	1.33	5.16	0.45	0.35	12.34	3.94	5.85	7.63	0.36	2.45	0.96
EBAE33	41.11	0.51	1.18	5.16	0.44	0.35	12.29	3.95	5.85	7.73	0.34	2.39	0.91
ABAE41	42.72	0.52	1.27	5.16	0.48	0.36	13.32	4.12	5.85	7.75	0.47	2.34	1.07
BBAE41	42.64	0.54	1.34	5.16	0.48	0.36	13.23	4.12	5.87	7.73	0.49	2.28	1.04
CBAE41	42.60	0.54	1.34	5.16	0.48	0.36	13.20	4.12	5.87	7.73	0.49	2.27	1.03
DBAE41	41.96	0.52	1.28	5.16	0.48	0.36	12.80	4.07	5.87	7.71	0.49	2.24	0.98
EBAE41	42.02	0.49	1.28	5.16	0.48	0.36	12.93	4.07	5.87	7.69	0.49	2.24	0.97
ABAE42	42.13	0.53	1.28	5.16	0.48	0.36	12.93	4.04	5.82	7.73	0.36	2.40	1.05
BBAE42	41.97	0.53	1.27	5.16	0.48	0.36	12.85	4.04	5.83	7.71	0.38	2.35	1.03
CBAE42	41.86	0.53	1.27	5.16	0.48	0.36	12.79	4.04	5.83	7.71	0.38	2.32	1.02
DBAE42	41.22	0.53	1.26	5.16	0.48	0.36	12.53	3.93	5.78	7.63	0.38	2.25	0.94
EBAE42	40.65	0.48	1.28	5.16	0.48	0.36	12.40	3.86	5.68	7.44	0.43	2.19	0.89
ABAE43	41.33	0.54	1.28	5.16	0.45	0.35	12.60	3.98	5.76	7.51	0.32	2.39	0.99
BBAE43	41.38	0.54	1.29	5.16	0.45	0.35	12.59	3.98	5.78	7.49	0.34	2.45	0.97
CBAE43	41.21	0.54	1.31	5.16	0.45	0.35	12.50	3.98	5.77	7.48	0.30	2.41	0.95
DBAE43	40.39	0.54	1.27	5.16	0.45	0.35	12.10	3.86	5.77	7.47	0.29	2.29	0.84
EBAE43	40.27	0.49	1.12	5.16	0.44	0.35	11.99	3.88	5.85	7.55	0.36	2.29	0.80
ABAE51	39.74	0.52	1.31	5.16	0.49	0.36	12.54	3.79	5.13	7.44	0.35	1.77	0.89
BBAE51	39.57	0.52	1.32	5.16	0.49	0.36	12.47	3.78	5.14	7.40	0.37	1.71	0.86
CBAE51	39.45	0.52	1.32	5.16	0.49	0.36	12.37	3.78	5.17	7.39	0.37	1.68	0.85
DBAE51	38.89	0.52	1.32	5.16	0.49	0.36	12.01	3.73	5.15	7.35	0.37	1.65	0.80
EBAE51	38.58	0.52	1.32	5.16	0.49	0.36	12.14	3.71	5.08	7.22	0.38	1.45	0.77
ABAE52	39.36	0.53	1.27	5.16	0.48	0.36	12.31	3.79	5.13	7.41	0.32	1.75	0.86
BBAE52	39.24	0.53	1.25	5.16	0.48	0.36	12.27	3.79	5.11	7.38	0.33	1.75	0.85
CBAE52	38.72	0.53	1.24	5.16	0.48	0.36	12.02	3.73	5.09	7.35	0.33	1.64	0.79
DBAE52	38.08	0.53	1.26	5.16	0.48	0.36	11.66	3.67	5.02	7.23	0.38	1.62	0.73
EBAE52	37.88	0.53	1.22	5.16	0.48	0.36	11.72	3.64	5.01	7.18	0.37	1.51	0.69
ABAE53	38.89	0.54	1.30	5.16	0.44	0.35	12.13	3.74	5.06	7.34	0.22	1.78	0.83
BBAE53	38.74	0.54	1.32	5.16	0.45	0.35	12.10	3.74	5.05	7.31	0.18	1.75	0.79
CBAE53	38.05	0.54	1.31	5.16	0.44	0.35	11.70	3.66	5.04	7.30	0.23	1.59	0.72

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DBAE53	37.82	0.53	1.31	5.16	0.45	0.35	11.54	3.62	5.13	7.30	0.22	1.58	0.63
EBAE53	37.28	0.52	1.28	5.16	0.44	0.35	11.44	3.56	4.99	7.17	0.24	1.52	0.62
ABAE61	42.83	0.52	1.27	5.16	0.43	0.35	13.38	4.12	5.88	7.74	0.38	2.58	1.07
BBAE61	42.67	0.52	1.27	5.16	0.43	0.35	13.28	4.12	5.88	7.74	0.38	2.53	1.05
CBAE61	42.52	0.52	1.27	5.16	0.43	0.35	13.16	4.12	5.88	7.73	0.38	2.51	1.03
DBAE61	41.99	0.52	1.28	5.16	0.43	0.35	12.93	4.05	5.80	7.62	0.37	2.51	0.99
EBAE61	41.91	0.53	1.28	5.16	0.43	0.35	12.71	4.06	5.87	7.68	0.39	2.51	0.98
ABAE62	42.05	0.52	1.23	5.16	0.44	0.35	12.87	4.03	5.84	7.71	0.38	2.47	1.05
BBAE62	41.83	0.52	1.23	5.16	0.44	0.35	12.69	4.03	5.83	7.69	0.40	2.44	1.04
CBAE62	41.38	0.52	1.23	5.16	0.44	0.35	12.46	3.97	5.83	7.68	0.39	2.35	1.00
DBAE62	40.97	0.52	1.23	5.16	0.44	0.35	12.22	3.92	5.83	7.68	0.38	2.31	0.92
EBAE62	41.18	0.47	1.23	5.16	0.44	0.35	12.33	3.97	5.91	7.77	0.34	2.31	0.90
ABAE63	41.12	0.54	1.29	5.16	0.44	0.35	12.27	3.92	5.76	7.49	0.39	2.50	1.01
BBAE63	40.39	0.54	1.29	5.16	0.44	0.35	11.97	3.84	5.78	7.45	0.39	2.27	0.92
CBAE63	40.23	0.54	1.29	5.16	0.44	0.35	11.83	3.84	5.77	7.44	0.39	2.27	0.92
DBAE63	39.95	0.54	1.28	5.16	0.44	0.35	11.66	3.80	5.78	7.43	0.39	2.26	0.85
EBAE63	39.58	0.53	1.24	5.16	0.43	0.35	11.35	3.76	5.83	7.50	0.38	2.21	0.84
ABAE71	42.63	0.52	1.27	5.16	0.48	0.36	13.29	4.11	5.84	7.70	0.47	2.44	1.05
BBAE71	42.58	0.52	1.27	5.16	0.48	0.36	13.31	4.08	5.86	7.70	0.47	2.39	1.03
CBAE71	42.26	0.52	1.27	5.16	0.48	0.36	13.08	4.08	5.85	7.68	0.49	2.35	1.01
DBAE71	42.01	0.53	1.26	5.16	0.48	0.36	12.89	4.04	5.86	7.68	0.51	2.34	0.96
EBAE71	41.84	0.50	1.28	5.16	0.48	0.36	12.88	4.02	5.80	7.62	0.51	2.34	0.94
ABAE72	41.81	0.53	1.20	5.16	0.48	0.36	12.76	4.01	5.78	7.68	0.41	2.42	1.04
BBAE72	42.07	0.53	1.20	5.16	0.48	0.36	12.82	4.01	5.79	7.69	0.46	2.55	1.01
CBAE72	41.46	0.53	1.20	5.16	0.48	0.36	12.43	3.96	5.79	7.67	0.48	2.45	0.97
DBAE72	40.85	0.53	1.19	5.16	0.48	0.36	12.25	3.89	5.75	7.60	0.47	2.27	0.90
EBAE72	40.55	0.49	1.17	5.16	0.48	0.36	12.21	3.86	5.70	7.48	0.50	2.27	0.88
ABAE73	40.97	0.53	1.27	5.16	0.44	0.35	12.26	3.89	5.64	7.45	0.39	2.60	1.00
BBAE73	40.85	0.53	1.27	5.16	0.44	0.35	12.18	3.89	5.67	7.44	0.41	2.54	0.96
CBAE73	40.26	0.53	1.27	5.16	0.44	0.35	11.86	3.81	5.67	7.43	0.41	2.41	0.91
DBAE73	39.84	0.53	1.27	5.16	0.44	0.35	11.61	3.77	5.69	7.41	0.40	2.39	0.81
EBAE73	39.51	0.50	1.27	5.16	0.44	0.35	11.67	3.75	5.64	7.40	0.33	2.20	0.79

Table 11-1. Average annual flood control value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Downstream of Fort Peck Dam	Downstream of Garrison Dam	Downstream of Oahe Dam	Downstream of Fort Randall Dam	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ABAE81	39.99	0.52	1.30	5.16	0.44	0.35	12.63	3.81	5.22	7.43	0.39	1.80	0.97
BBAE81	39.61	0.52	1.30	5.16	0.44	0.35	12.49	3.81	5.21	7.45	0.26	1.76	0.89
CBAE81	39.42	0.52	1.30	5.16	0.44	0.35	12.37	3.80	5.21	7.44	0.26	1.73	0.87
DBAE81	38.80	0.52	1.30	5.16	0.44	0.35	12.14	3.73	5.10	7.30	0.24	1.73	0.83
EBAE81	39.05	0.48	1.31	5.16	0.40	0.35	12.03	3.76	5.16	7.48	0.20	1.94	0.77
ABAE82	39.55	0.54	1.19	5.16	0.44	0.35	12.33	3.80	5.26	7.38	0.30	1.90	0.90
BBAE82	39.33	0.54	1.19	5.16	0.44	0.35	12.16	3.79	5.25	7.37	0.32	1.87	0.89
CBAE82	38.78	0.54	1.21	5.16	0.44	0.35	11.84	3.74	5.23	7.34	0.31	1.78	0.84
DBAE82	38.47	0.54	1.19	5.16	0.44	0.35	11.64	3.68	5.22	7.33	0.30	1.82	0.79
EBAE82	38.07	0.49	1.31	5.16	0.43	0.35	11.40	3.54	5.07	7.17	0.30	2.23	0.67
ABAE83	39.02	0.54	1.28	5.16	0.44	0.35	11.90	3.73	5.29	7.35	0.30	1.80	0.88
BBAE83	39.15	0.54	1.28	5.16	0.44	0.35	12.01	3.74	5.31	7.33	0.30	1.82	0.86
CBAE83	38.30	0.54	1.28	5.16	0.44	0.35	11.50	3.65	5.29	7.31	0.30	1.68	0.80
DBAE83	37.74	0.54	1.31	5.16	0.43	0.35	11.20	3.60	5.27	7.26	0.25	1.65	0.71
EBAE83	37.47	0.44	1.20	5.16	0.38	0.35	11.37	3.64	5.59	7.19	0.25	1.37	0.54
ABAE91	39.39	0.52	1.27	5.16	0.48	0.36	12.49	3.75	5.03	7.33	0.43	1.76	0.86
BBAE91	39.23	0.52	1.27	5.16	0.48	0.36	12.49	3.73	5.05	7.32	0.43	1.63	0.84
CBAE91	38.82	0.52	1.27	5.16	0.48	0.36	12.18	3.73	5.04	7.30	0.45	1.58	0.81
DBAE91	38.42	0.52	1.27	5.16	0.48	0.36	12.01	3.68	5.00	7.22	0.44	1.57	0.76
EBAE91	38.20	0.50	1.25	5.16	0.48	0.36	12.00	3.66	4.94	7.15	0.45	1.57	0.74
ABAE92	39.21	0.53	1.19	5.16	0.48	0.36	12.16	3.75	5.04	7.32	0.40	2.00	0.84
BBAE92	38.81	0.53	1.19	5.16	0.48	0.36	12.08	3.74	5.06	7.30	0.35	1.75	0.82
CBAE92	38.36	0.53	1.19	5.16	0.48	0.36	11.83	3.69	5.06	7.29	0.36	1.65	0.77
DBAE92	38.57	0.53	1.18	5.16	0.48	0.36	11.76	3.70	5.40	7.23	0.36	1.67	0.75
EBAE92	37.51	0.49	1.15	5.16	0.48	0.36	11.50	3.61	4.92	7.16	0.41	1.61	0.68
ABAE93	38.53	0.53	1.28	5.16	0.44	0.35	11.82	3.68	5.03	7.27	0.28	1.89	0.80
BBAE93	38.40	0.53	1.28	5.16	0.44	0.35	11.75	3.68	5.04	7.25	0.29	1.85	0.77
CBAE93	37.76	0.53	1.27	5.16	0.44	0.35	11.50	3.59	5.05	7.20	0.28	1.70	0.70
DBAE93	37.20	0.53	1.28	5.16	0.44	0.35	11.17	3.53	4.99	7.18	0.28	1.67	0.63
EBAE93	37.72	0.49	1.19	5.16	0.44	0.35	11.30	3.61	5.15	7.36	0.28	1.79	0.60
EVQ2XX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

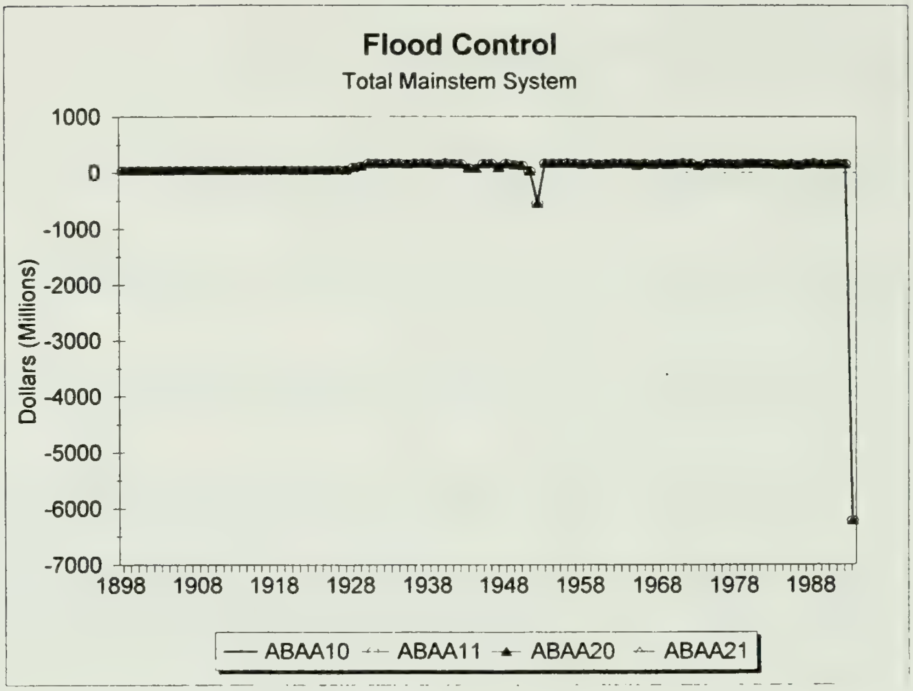

Figure 11-1. Annual flood control benefits of the total Mainstem System over the 93-year simulation period.

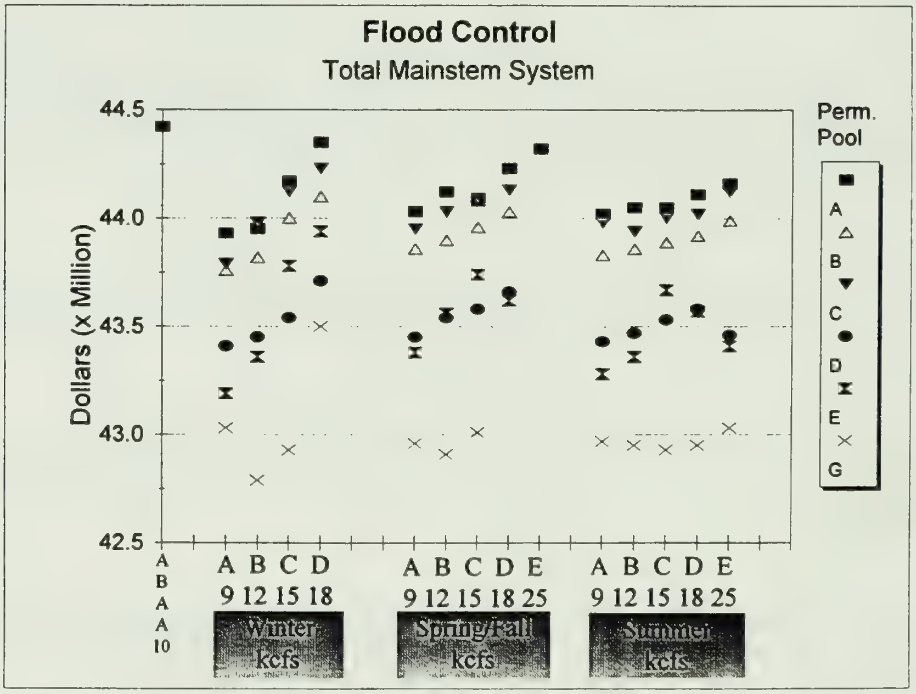

Figure 11-2. Average annual flood control benefits of the Mainstem System by nonnavigation service level.

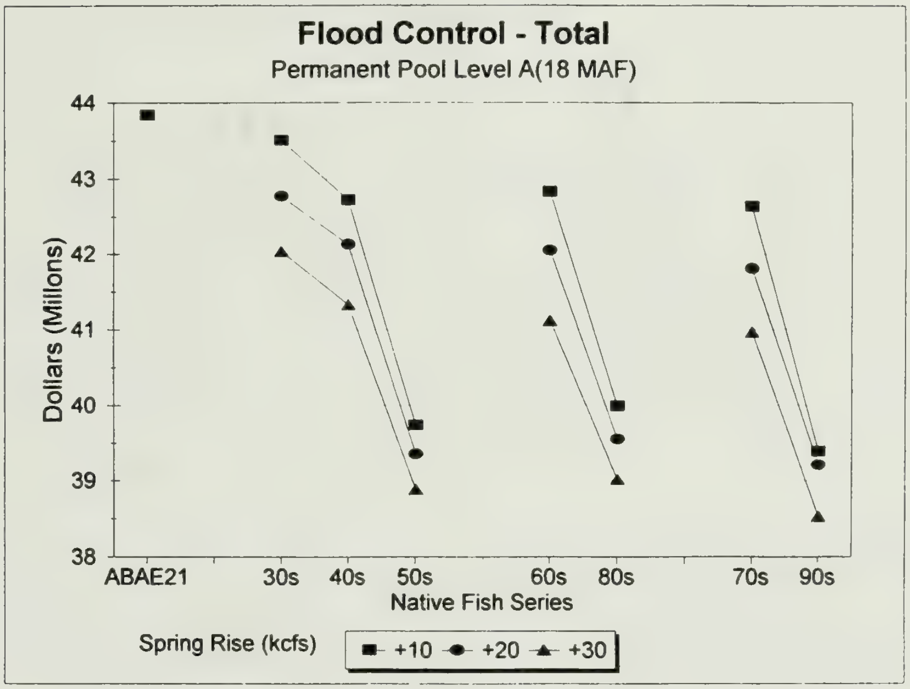

Figure 11-3. Average annual flood control benefits of the Mainstem System by native fish flow level and degree of flood control constraint.

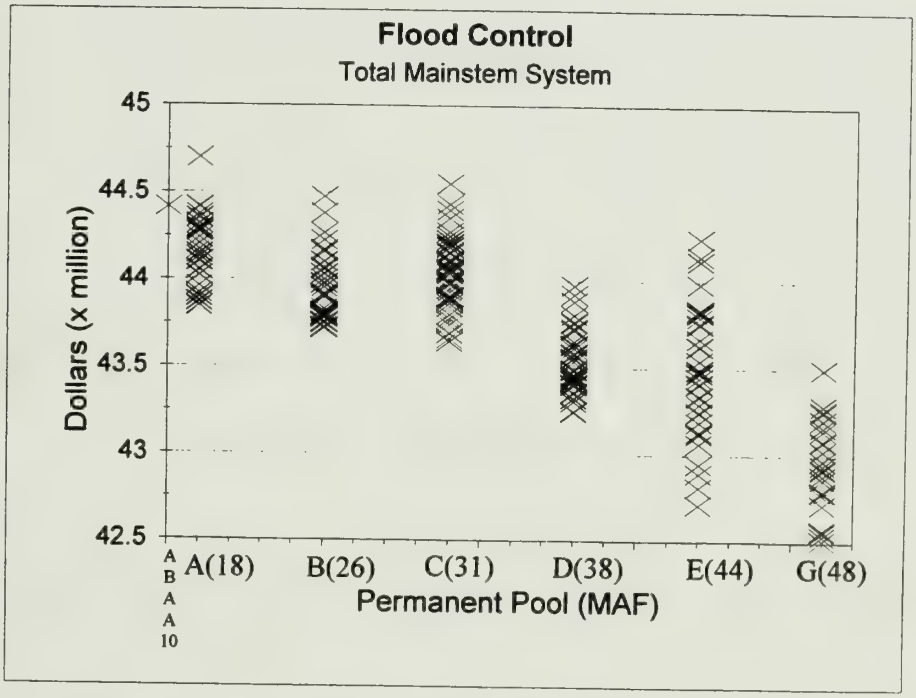

Figure 11-4. Average annual flood control benefits of the Mainstem System by permanent pool level.

12.0 WATER SUPPLY

Water is withdrawn from the Missouri River and its mainstem lakes for cooling purposes in the production of electricity; for municipal water supply; and for commercial, industrial, irrigation, domestic, and public consumptive use. Changes in river flows and lake elevations affect the cost of operating intake facilities for these uses. In addition to water access problems at some intakes if water levels drop too low, thermal powerplants require sufficient water depth to meet state water temperature standards for cooling water discharge. Low water levels might increase day-to-day operating costs, or in extreme cases lead to capital costs for intake modification, location of an alternative water source, or in the case of powerplants, construction of cooling towers or in some cases new facilities, to meet state temperature discharge standards.

The estimated NED and direct RED value of water supply for the Mainstem System is $546.2 million under existing operations. The estimated water supply benefits for the other 382 alternatives range from a high of $549.2 million for alternative DCBE21 to a low of $510.9 million for alternative GAAA21 (Table 12-1). Thus, within the full range of alternatives that were studied, the alternative with the lowest water supply benefit is about 7 percent lower than the alternative with the highest benefit. Current operations fall within 1 percent of the highest water supply benefit value.

The greatest water supply benefits occur in the Omaha and Nebraska City reaches and downstream of Gavins Point dam. Other significant water supply benefits occur downstream of Garrison Dam and in the Kansas City, Hermann, Sioux City, and St. Joseph reaches. In those alternatives where water supply benefits are reduced, the most significant impacts are in those reaches where thermal powerplants are located. When the supply of water is insufficient, thermal powerplants incur high costs for cooling tower and new facilities construction and/or replacement power. These costs, which reduce the overall water supply value, greatly outweigh any positive or negative impacts occurring at other intake facilities located on the Missouri River. Therefore, the majority of the losses in water supply value are experienced in the reaches downstream of Gavins Point, where 18 of the 25 powerplants along the Mainstem System are located.

Various changes in system operation would affect water supply benefits in different ways. In summary:

- The modified navigation criteria would slightly improve the average annual water supply value over the Water Control Plan, because it would maintain the water supply value in one particular drought year, 1937.

- Modified intrasystem regulation would have no effect on water supply benefits.

- Changes to minimum nonnavigation service levels generally have only small effects on water supply benefits. The exception is a winter flow at level A (9 kcfs), which dramatically increases water supply costs and correspondingly reduces net benefits. A summer nonnavigation service level of 25 kcfs decreases water supply costs; however, the change in net benefits is not as dramatic as with the 9 kcfs winter service level.

- Increases in spring service levels associated with the Native Fish Series would slightly to significantly decrease the river's water supply value, particularly when higher spring flows had to be made up with lower summer flows.

- Permanent pool criteria determine how low total system water storage is allowed to fall during droughts, and therefore the extent to which releases can be made to support downstream water supply needs. During drought years, higher permanent pool levels are associated with lower water supply values. In nondrought years, the opposite is true.

12.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

In most years, the modified navigation criteria would have no effect on water supply benefits (Figure 12-1). Even in most drought years, such as 1928, 1958, and 1988, the modified criteria would have no perceptible effect. In those years, under both the old and modified navigation criteria, water supply benefits would be moderately to drastically reduced because additional costs would be incurred to improve intake structures, buy replacement power, or build cooling towers to keep all thermal powerplants in operation.

In only one year of the 96-year simulation period would the modified navigation criteria have any appreciable effect on water supply: 1937 (Figure 12-1). In that year, the modified navigation criteria would conserve enough water in the early drought years to preserve navigation service in 1937. The water used to support navigation in that year would also maintain adequate water depth to keep most water supply intakes in operation and keep thermal powerplants operating. Overall, the maintenance of water supply benefits in that one year would increase average annual water supply benefits by about $1.3 million, from $546.2 under current operations (ABAA10) to $547.5 under alternative ABAA20.

Modified intrasystem regulation would have no effect on water supply benefits.

12.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVEL

The minimum nonnavigation service level in winter has a major influence on water supply value (Figure 12-2). The A-level (9 kcfs) in winter results in considerable additional costs in several drought years (1938, 1958, and 1988) because replacement power would have to be purchased or cooling towers would need to be built to keep thermal powerplants in operation. The additional costs, and resulting decrease in net benefits, would be particularly applicable to the Omaha, Nebraska City, St. Joseph, and Kansas City reaches where major thermal powerplants are located. Powerplants in the Sioux City and Hermann reaches that require high flows year round are not impacted as dramatically by the A-level in winter. Net benefits are increased when summer nonnavigation service level is increased to 25 kcfs, but the change is not as dramatic as when winter nonnavigation service level is increased to 12 kcfs.

The minimum nonnavigation service level in the spring/fall generally has less effect on water supply values (Figure 12-2).

12.3 EFFECT OF NATIVE FISH SERIES

All alternatives that provide higher spring flows for native fish reduce water supply benefits compared to the current situation. Figure 12-3 illustrates the effects when combined with permanent pool level A. Comparable changes occur at other permanent pool levels. Water supply benefits drop only slightly as the spring flow becomes progressively higher (Figure 12-3).

The Native Fish Series flows with the most significant effect on water supply values are those that make up for the water in the high spring flows by reducing summer flows (Figure 12-3). In those alternatives, summer flows would not be sufficient to support thermal powerplant operations.

12.4 PERMANENT POOL LEVEL

With regard to water supply, some permanent pool levels perform better during drought years and others perform better during nondrought years. In general, higher permanent pool levels are associated with lower water supply benefits (Figure 12-4).

During droughts such as the 1930s, when water releases to the river are lower under the higher permanent pool alternatives, water supply benefits drop (Figure 12-5). Despite benefits to water supply intakes on the lakes from higher water levels at the higher permanent pools, there are greater corresponding losses for water supply intakes in the river between and below the lakes, where the lower average flows that go along with higher permanent pools result in decreased net benefits.

During nondrought years, however, the alternatives with higher permanent pool levels provide slightly higher water supply benefits (Figure 12-5). Overall, the many nondrought years of higher benefits offset the few drought years of lower benefits, yielding similar average annual benefits regardless of permanent pool level (only with higher nonnavigation service levels). With lower nonnavigation service levels the differences in benefits are much more dramatic. For example, the average annual water supply value of alternative ABAE21 ($547.3 million) is virtually the same as the water supply value of alternative EBAE21 ($547.8).

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ABAA10	546.2	0.5	1.2	5.1	84.5	3.9	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.0	21.7	44.1	0.6	39.1
ABAA11	546.1	0.5	1.2	5.1	84.4	3.9	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.0	21.7	44.1	0.6	39.1
ABAA20	547.5	0.5	1.2	5.3	84.5	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.1
AAAA21	519.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.3	20.9	40.7	0.6	38.9
AAAB21	519.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.3	20.9	40.7	0.6	38.9
AAAC21	519.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.3	20.9	40.7	0.6	38.9
AAAD21	519.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.3	20.9	40.7	0.6	38.9
AAAE21	519.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.3	20.9	40.7	0.6	38.9
AABB21	520.6	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.7	124.4	20.9	40.9	0.6	38.9
AABC21	520.6	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.7	124.4	20.9	40.9	0.6	38.9
AABD21	520.6	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.7	124.4	20.9	40.9	0.6	38.9
AABE21	520.6	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.7	124.4	20.9	40.9	0.6	38.9
AACC21	520.6	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.4	20.9	41.3	0.6	38.9
AACD21	520.6	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.4	20.9	41.3	0.6	38.9
AACE21	520.6	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.3	124.4	20.9	41.3	0.6	38.9
AADD21	521.2	0.5	1.2	5.4	84.4	4.2	4.2	2.1	0.0	0.6	1.4	28.4	162.5	124.5	20.7	41.6	0.6	38.9
AADE21	521.9	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	163.0	124.9	20.7	41.6	0.6	38.9
AAEE21	522.9	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.8	125.2	20.9	42.3	0.6	38.9
ABAA21	547.3	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.1
ABAB21	547.3	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.1
ABAC21	547.3	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.1
ABAD21	547.3	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.1
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ABBD21	547.1	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.6	130.2	21.7	44.1	0.6	39.1
ABBE21	547.5	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.9	130.4	21.7	44.1	0.6	39.1
ABCC21	546.3	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.1	129.8	21.7	44.1	0.6	39.1
ABCD21	546.6	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.3	130.0	21.7	44.2	0.6	39.1
ABCE21	547.5	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.8	130.4	21.7	44.2	0.6	39.1
ABDD21	546.1	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.0	129.8	21.7	44.2	0.6	39.1
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ACDD21	547.4	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.8	129.7	21.9	44.2	0.6	39.4
ACDE21	549.0	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	179.7	130.4	21.9	44.2	0.6	39.4
ADAA21	545.7	0.5	1.2	5.3	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.0	129.5	21.7	44.0	0.6	39.1
ADAB21	546.3	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.5	129.7	21.7	44.1	0.6	39.1
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ADAD21	546.9	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.7	129.9	21.7	44.1	0.6	39.1
ADAE21	547.7	0.5	1.2	5.3	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	179.1	130.4	21.7	44.1	0.6	39.1
ADBB21	546.5	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.2	129.3	21.9	44.1	0.6	39.4
ADBC21	547.0	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.6	129.6	21.9	44.2	0.6	39.4
ADBD21	547.2	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.6	129.7	21.9	44.2	0.6	39.4
ADBE21	548.8	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	179.5	130.4	21.9	44.2	0.6	39.4
ADCC21	546.0	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	177.9	129.2	21.9	44.2	0.6	39.4
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ADDE21	548.9	0.5	1.2	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	179.5	130.4	21.9	44.2	0.6	39.6
BAAA21	520.0	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.4	124.3	20.9	40.7	0.6	38.9
BAAB21	520.0	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	28.4	162.4	124.3	20.9	40.7	0.6	38.9
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BCAB21	546.4	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.4	129.7	21.7	44.0	0.6	39.1
BCAC21	546.9	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.8	129.9	21.7	44.0	0.6	39.1
BCAD21	546.9	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	129.9	21.7	44.1	0.6	39.1
BCAE21	547.8	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	179.1	130.4	21.7	44.0	0.6	39.1
BCBB21	546.4	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.1	129.3	21.9	44.1	0.6	39.4
BCBC21	546.3	0.5	1.2	5.5	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.1	129.3	21.9	44.1	0.6	39.4
BCBD21	547.4	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.7	129.7	21.9	44.1	0.6	39.4
BCBE21	548.8	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	179.5	130.4	21.9	44.1	0.6	39.4
BCCC21	545.4	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.4	129.0	21.9	44.1	0.6	39.4
BCCD21	546.9	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.3	129.5	21.9	44.1	0.6	39.4
BCCE21	548.7	0.5	1.2	5.5	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	179.2	130.4	21.9	44.1	0.6	39.4
BCDD21	546.7	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.2	129.4	21.9	44.2	0.6	39.4
BCDE21	548.9	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	179.4	130.4	21.9	44.2	0.6	39.4
BDAA21	544.3	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.1	128.9	21.7	44.0	0.6	39.1
BDAB21	544.8	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	177.3	129.2	21.7	44.0	0.6	39.1
BDAC21	545.4	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.6	129.3	21.7	44.0	0.6	39.1
BDAD21	545.6	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.7	129.5	21.7	44.1	0.6	39.1
BDAE21	547.5	0.5	1.2	5.4	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	178.8	130.4	21.7	44.1	0.6	39.1
BDBB21	544.4	0.5	1.2	5.5	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	176.8	128.7	21.9	44.1	0.6	39.4
BDBC21	545.3	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.3	128.9	21.9	44.1	0.6	39.4
BDBD21	546.3	0.5	1.2	5.5	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.8	129.4	21.9	44.2	0.6	39.4
BDBE21	548.5	0.5	1.2	5.5	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.1	179.1	130.4	21.9	44.1	0.6	39.4
BDCC21	544.8	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.0	128.8	21.9	44.1	0.6	39.4
BDCD21	546.6	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	178.0	129.4	21.9	44.2	0.6	39.4
BDCE21	548.5	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	179.0	130.4	21.9	44.2	0.6	39.4
BDDD21	545.9	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.6	129.1	21.9	44.2	0.6	39.4
CAAA21	518.3	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	28.3	161.4	123.7	20.7	40.7	0.6	38.9
CAAB21	517.3	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	28.3	160.9	123.4	20.6	40.5	0.6	38.9
CAAC21	517.5	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	161.1	123.5	20.6	40.5	0.6	38.9
CAAD21	517.8	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	161.2	123.6	20.6	40.5	0.6	38.9
CAAE21	519.3	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	162.0	124.1	20.7	40.7	0.6	38.9
CABB21	518.5	0.5	1.2	6.0	84.4	4.4	4.2	2.1	0.0	0.6	1.4	28.3	161.4	123.3	20.7	40.8	0.6	38.9
CABC21	518.8	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	161.8	123.5	20.7	40.9	0.6	38.9
CABD21	519.4	0.5	1.2	5.5	84.4	4.8	4.2	2.1	0.0	0.6	1.4	28.3	161.7	123.8	20.7	40.9	0.6	38.9
CABE21	520.0	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	162.3	124.3	20.7	40.9	0.6	38.9
CACC21	519.0	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	161.5	123.7	20.7	41.3	0.6	38.9
CACD21	519.4	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	161.6	123.8	20.7	41.3	0.6	38.9
CACE21	520.8	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	28.3	162.5	124.5	20.7	41.3	0.6	38.9
CADD21	519.0	0.5	1.2	5.5	84.4	4.8	4.2	2.1	0.0	0.6	1.4	28.3	160.9	123.6	20.7	41.4	0.6	38.9
CADE21	521.5	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	28.3	162.6	124.7	20.7	41.5	0.6	38.9
CBAA21	544.6	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	176.8	129.3	21.7	44.0	0.6	39.0
CBAB21	544.4	0.5	1.2	5.5	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	176.7	129.3	21.7	44.0	0.6	39.0
CBAC21	545.2	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	177.1	129.5	21.7	44.0	0.6	39.1

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
CBAD21	546.0	0.5	1.2	5.5	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	177.6	129.9	21.7	44.0	0.6	39.1
CBAE21	547.0	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.0	0.6	39.1
CBBB21	544.9	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	177.0	129.3	21.7	44.0	0.6	39.1
CBBC21	545.7	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	177.5	129.6	21.7	44.1	0.6	39.1
CBBD21	545.9	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	177.7	129.7	21.7	44.1	0.6	39.1
CBBE21	547.2	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.3	130.4	21.7	44.1	0.6	39.1
CBCC21	544.8	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	176.9	129.3	21.7	44.1	0.6	39.1
CBCD21	546.1	0.5	1.2	5.5	84.4	4.7	4.2	2.1	0.0	0.6	1.4	29.1	177.4	129.6	21.7	44.1	0.6	39.1
CBCE21	547.4	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	178.4	130.4	21.7	44.1	0.6	39.1
CBDD21	545.5	0.5	1.2	5.9	84.4	5.0	4.2	2.1	0.0	0.6	1.4	29.1	176.5	129.1	21.7	44.1	0.6	39.1
CBDE21	547.4	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	178.4	130.4	21.7	44.1	0.6	39.1
CCAA21	544.4	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	177.0	128.9	21.7	44.0	0.6	39.1
CCAB21	545.4	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	177.7	129.3	21.7	44.0	0.6	39.1
CCAC21	546.1	0.5	1.2	5.4	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.2	129.6	21.7	44.0	0.6	39.1
CCAD21	546.4	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.2	129.7	21.7	44.0	0.6	39.1
CCAE21	547.6	0.5	1.2	5.5	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.8	130.4	21.7	44.0	0.6	39.1
CCBB21	546.2	0.5	1.2	5.5	84.4	4.8	4.2	2.1	0.0	0.6	1.4	29.1	177.4	129.1	21.9	44.1	0.6	39.4
CCBC21	546.2	0.5	1.2	5.4	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	177.8	129.3	21.9	44.1	0.6	39.4
CCBD21	547.1	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	178.3	129.6	21.9	44.1	0.6	39.4
CCBE21	548.6	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	179.0	130.4	21.9	44.1	0.6	39.4
CCCC21	544.8	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	177.0	128.8	21.9	44.1	0.6	39.4
CCCD21	546.9	0.5	1.2	5.9	84.4	5.0	4.2	2.1	0.0	0.6	1.4	29.1	177.4	129.1	21.9	44.1	0.6	39.4
CCCE21	548.8	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	179.1	130.4	21.9	44.1	0.6	39.4
CCDD21	545.5	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	177.1	129.0	21.9	44.2	0.6	39.4
CDAA21	543.1	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	176.1	128.6	21.7	44.0	0.6	39.1
CDAB21	544.4	0.5	1.2	5.4	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	177.0	129.1	21.7	44.0	0.6	39.1
CDAC21	544.6	0.5	1.2	5.5	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.1	177.1	129.1	21.7	44.0	0.6	39.1
CDAD21	545.1	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	177.2	129.4	21.7	44.1	0.6	39.1
CDAE21	547.2	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	178.4	130.3	21.7	44.0	0.6	39.1
CDBB21	544.6	0.5	1.2	5.5	84.4	4.7	4.2	2.1	0.0	0.6	1.4	29.1	176.4	128.6	21.9	44.1	0.6	39.4
CDBC21	544.7	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	176.8	128.8	21.9	44.1	0.6	39.4
CDBD21	546.8	0.5	1.2	5.9	84.4	4.9	4.2	2.1	0.0	0.6	1.4	29.1	177.3	129.2	21.9	44.1	0.6	39.4
CDBE21	548.5	0.5	1.2	5.5	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	178.8	130.4	21.9	44.1	0.6	39.4
CDCC21	544.9	0.5	1.2	5.4	84.4	4.9	4.2	2.1	0.0	0.6	1.4	29.1	176.5	128.5	21.9	44.1	0.6	39.4
CDCD21	545.1	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	176.7	129.0	21.9	44.2	0.6	39.4
CDDD21	545.1	0.5	1.2	5.5	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	176.8	128.8	21.9	44.2	0.6	39.4
DAAA21	518.3	0.5	1.2	5.6	84.4	5.3	4.2	2.1	0.0	0.6	1.4	28.3	160.6	123.4	20.7	40.7	0.6	38.9
DAAB21	518.7	0.5	1.2	5.6	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	161.0	123.6	20.7	40.7	0.6	38.9
DAAC21	518.7	0.5	1.2	6.0	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	160.8	123.5	20.7	40.7	0.6	38.9
DAAD21	519.4	0.5	1.2	6.0	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	161.2	123.7	20.7	40.7	0.6	38.9
DAAE21	520.1	0.5	1.2	5.6	84.4	5.0	4.2	2.1	0.0	0.6	1.4	28.3	161.9	124.2	20.7	40.7	0.6	38.9
DABB21	518.4	0.5	1.2	5.5	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	160.9	123.4	20.7	40.8	0.6	38.9
DABC21	519.4	0.5	1.2	5.5	84.4	5.3	4.2	2.1	0.0	0.6	1.4	28.3	161.3	123.6	20.7	40.9	0.6	38.9
DABD21	522.4	0.5	1.2	6.0	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.4	162.7	124.3	20.9	41.1	0.6	38.9

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DABE21	521.1	0.5	1.2	6.1	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	162.0	124.3	20.7	40.9	0.6	38.9
DACC21	518.9	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	28.3	160.2	123.1	20.7	41.3	0.6	38.9
DACD21	518.9	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	28.3	160.2	123.1	20.7	41.3	0.6	38.9
DACE21	522.1	0.5	1.2	6.1	84.4	5.1	4.2	2.1	0.0	0.6	1.4	28.3	162.2	124.5	20.7	41.3	0.6	38.9
DADD21	520.5	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	28.3	161.1	123.6	20.7	41.5	0.6	38.9
DBAA21	542.5	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	174.2	128.2	21.7	43.9	0.6	39.0
DBAB21	544.0	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	175.2	128.8	21.7	43.9	0.6	39.0
DBAC21	545.3	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	176.0	129.2	21.7	44.0	0.6	39.0
DBAD21	546.1	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	176.4	129.5	21.7	44.0	0.6	39.0
DBAE21	547.7	0.5	1.2	6.1	84.4	5.0	4.2	2.1	0.0	0.6	1.4	29.0	177.6	130.3	21.7	44.0	0.6	39.1
DBBB21	544.7	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	175.7	128.8	21.7	44.0	0.6	39.1
DBBC21	545.2	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	176.0	128.9	21.7	44.1	0.6	39.1
DBBD21	546.4	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	176.7	129.4	21.7	44.1	0.6	39.1
DBBE21	548.5	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.1	0.6	39.1
DBCC21	545.0	0.5	1.2	6.0	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	175.9	128.9	21.7	44.1	0.6	39.1
DBCD21	545.4	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	176.0	129.0	21.7	44.1	0.6	39.1
DBDD21	545.2	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	176.0	128.9	21.7	44.1	0.6	39.1
DCAA21	543.3	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	175.1	128.2	21.7	43.9	0.6	39.1
DCAB21	545.1	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	176.2	128.8	21.7	43.9	0.6	39.1
DCAC21	545.6	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	176.5	128.9	21.7	44.0	0.6	39.1
DCAD21	546.8	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.2	129.4	21.7	44.0	0.6	39.1
DCAE21	548.6	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.3	21.7	44.0	0.6	39.1
DCBB21	544.6	0.5	1.2	6.0	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	175.7	128.3	21.9	43.9	0.6	39.4
DCBC21	545.8	0.5	1.2	6.0	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	176.5	128.7	21.9	44.0	0.6	39.4
DCBD21	547.4	0.5	1.2	6.0	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	177.5	129.3	21.9	44.1	0.6	39.4
DCBE21	549.2	0.5	1.2	6.1	84.4	5.1	4.2	2.1	0.0	0.6	1.4	29.1	178.2	130.4	21.9	44.1	0.6	39.4
DCCC21	544.5	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	175.5	128.1	21.9	44.1	0.6	39.4
DCCD21	546.4	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	176.5	128.9	21.9	44.1	0.6	39.4
DCDD21	544.9	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	175.5	128.4	21.9	44.1	0.6	39.4
DDAA21	541.0	0.5	1.2	6.0	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	173.7	127.3	21.7	43.8	0.6	39.1
DDAB21	541.9	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	173.9	127.8	21.7	43.9	0.6	39.1
DDAC21	544.1	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	175.3	128.5	21.7	44.0	0.6	39.1
DDAD21	545.6	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	176.3	129.1	21.7	44.0	0.6	39.1
DDAE21	547.7	0.5	1.2	6.1	84.4	5.1	4.2	2.1	0.0	0.6	1.4	29.1	177.3	130.3	21.7	44.0	0.6	39.1
DDBB21	543.1	0.5	1.2	6.0	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	174.8	127.7	21.9	44.0	0.6	39.4
DDBC21	544.6	0.5	1.2	6.1	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.1	175.5	128.3	21.9	44.1	0.6	39.4
DDBD21	546.0	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	176.2	128.9	21.9	44.1	0.6	39.4
DDCC21	543.3	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	174.6	127.8	21.9	44.1	0.6	39.4
DDCD21	544.5	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.1	175.1	128.4	21.9	44.1	0.6	39.4
EAAA21	516.0	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.3	159.0	121.8	20.7	40.6	0.6	38.9
EAAB21	518.2	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.3	160.2	122.7	20.7	40.8	0.6	38.9
EAAC21	518.4	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.3	160.3	122.9	20.7	40.7	0.6	38.9
EAAD21	521.7	0.5	1.2	6.1	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.3	161.4	124.2	20.7	41.4	0.6	39.0
EAAE21	521.0	0.5	1.2	6.1	84.4	5.4	4.2	2.1	0.0	0.6	1.4	28.3	161.8	124.3	20.6	40.7	0.6	38.9

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
EABB21	516.9	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.3	159.4	122.3	20.7	40.8	0.6	38.9
EABC21	521.1	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	160.9	123.6	20.7	41.5	0.6	39.3
EABD21	521.9	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	161.6	124.0	20.7	41.4	0.6	39.3
EABE21	521.9	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	162.2	124.4	20.7	40.9	0.6	38.9
EACC21	518.6	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	159.9	122.9	20.7	41.3	0.6	38.9
EACD21	520.3	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	161.1	123.5	20.7	41.3	0.6	38.9
EADD21	520.2	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	28.3	160.7	123.4	20.7	41.5	0.6	38.9
EBAA21	539.3	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	172.3	127.2	21.5	43.5	0.6	39.0
EBAB21	542.3	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	173.9	128.1	21.7	43.9	0.6	39.0
EBAC21	543.2	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	174.4	128.4	21.7	43.9	0.6	39.0
EBAD21	545.8	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	176.1	129.3	21.7	44.0	0.6	39.0
EBAE21	547.8	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	177.2	130.3	21.7	44.0	0.6	39.0
EBBB21	541.7	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	173.4	127.6	21.7	43.9	0.6	39.3
EBBC21	543.6	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	174.7	128.4	21.7	44.0	0.6	39.0
EBBD21	546.2	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	176.5	129.3	21.7	44.1	0.6	39.1
EBCC21	543.4	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.1	174.4	128.1	21.7	44.0	0.6	39.3
EBCD21	545.6	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	176.0	129.0	21.7	44.1	0.6	39.1
ECAA21	538.7	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	172.2	126.7	21.6	43.4	0.6	39.0
ECAB21	541.6	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	173.7	127.6	21.7	43.9	0.6	39.1
ECAC21	543.9	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	175.0	128.4	21.7	44.0	0.6	39.1
ECAD21	545.5	0.5	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	176.0	129.1	21.7	44.0	0.6	39.1
ECBB21	542.7	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	174.2	127.6	21.9	43.9	0.6	39.4
ECBC21	544.2	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	175.0	128.1	21.9	44.0	0.6	39.4
ECBD21	546.6	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	176.5	129.0	21.9	44.1	0.6	39.4
ECCC21	541.7	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	173.4	127.2	21.9	44.0	0.6	39.4
ECCD21	545.0	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	175.3	128.4	21.9	44.1	0.6	39.4
EDAA21	535.2	0.6	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	169.7	125.5	21.7	43.5	0.6	39.1
EDAB21	537.7	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	170.9	126.4	21.7	43.8	0.6	39.1
EDAC21	540.7	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	172.7	127.5	21.7	43.9	0.6	39.1
EDBB21	538.6	0.5	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	171.2	126.3	21.9	43.9	0.6	39.4
EDBC21	541.8	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	173.3	127.3	21.9	44.0	0.6	39.4
EDBD21	544.6	0.6	1.2	6.2	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.1	174.9	128.4	21.9	44.1	0.6	39.4
EDCC21	1082.0	1.1	2.4	12.5	168.9	11.1	8.5	4.1	0.0	1.2	2.7	58.2	345.6	253.9	43.9	88.1	1.2	78.8
GAAA21	510.9	0.6	1.2	6.3	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.1	154.3	121.6	20.6	40.5	0.6	38.8
GAAB21	513.5	0.6	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	28.1	156.4	122.0	20.7	40.7	0.6	38.8
GAAC21	515.4	0.6	1.2	6.2	84.4	5.6	4.2	2.0	0.0	0.6	1.4	28.1	157.5	122.6	20.7	40.8	0.6	38.8
GAAD21	517.1	0.6	1.2	6.2	84.4	5.6	4.2	2.0	0.0	0.6	1.4	28.1	158.5	123.5	20.7	40.8	0.6	38.8
GAAE21	518.0	0.6	1.2	6.2	84.4	5.6	4.2	2.0	0.0	0.6	1.4	28.1	158.8	124.2	20.6	40.7	0.6	38.8
GABB21	515.4	0.6	1.2	6.3	84.5	5.8	4.2	2.0	0.0	0.6	1.4	28.2	157.1	122.1	20.9	41.3	0.6	38.8
GABC21	518.7	0.6	1.2	6.3	84.5	5.8	4.2	2.0	0.0	0.6	1.4	28.2	159.0	123.1	21.0	41.6	0.6	38.8
GABD21	521.0	0.6	1.2	6.3	84.4	5.7	4.2	2.0	0.0	0.6	1.4	28.2	160.2	124.2	21.0	41.7	0.6	38.8
GACC21	518.8	0.6	1.2	6.3	84.5	5.7	4.2	2.0	0.0	0.6	1.4	28.2	158.6	123.2	21.0	42.0	0.6	38.9
GACD21	519.6	0.6	1.2	6.3	84.5	5.6	4.2	2.0	0.0	0.6	1.4	28.2	159.1	123.8	20.9	41.9	0.6	38.8
GBAA21	535.2	0.6	1.2	6.3	84.4	5.7	4.2	2.1	0.0	0.6	1.4	29.0	169.3	125.6	21.7	43.6	0.6	39.0

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
GBAB21	538.9	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	171.5	126.9	21.7	43.8	0.6	39.0
GBAC21	541.0	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	172.8	127.6	21.7	43.9	0.6	39.0
GBAD21	543.9	0.6	1.2	6.3	84.4	5.7	4.2	2.0	0.0	0.6	1.4	29.0	174.5	128.7	21.7	44.0	0.6	39.0
GBBB21	537.5	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	170.5	126.2	21.9	43.8	0.6	39.0
GBBC21	541.8	0.6	1.2	6.3	84.4	5.7	4.2	2.0	0.0	0.6	1.4	29.0	173.4	127.7	21.7	44.0	0.6	39.0
GBBD21	544.5	0.6	1.2	6.3	84.4	5.6	4.2	2.0	0.0	0.6	1.4	29.0	175.0	128.8	21.7	44.0	0.6	39.0
GBCC21	540.8	0.6	1.2	6.3	84.4	5.7	4.2	2.0	0.0	0.6	1.4	29.1	172.6	127.3	21.9	44.0	0.6	39.0
GCAA21	534.0	0.6	1.2	6.3	84.4	5.8	4.2	2.1	0.0	0.6	1.4	29.0	168.8	125.1	21.7	43.3	0.6	39.0
GCAB21	537.3	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	170.6	126.2	21.7	43.7	0.6	39.0
GCAC21	540.7	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	172.7	127.3	21.7	43.9	0.6	39.0
GCAD21	544.1	0.6	1.2	6.3	84.4	5.7	4.2	2.0	0.0	0.6	1.4	29.0	174.8	128.6	21.7	44.0	0.6	39.0
GCBB21	538.0	0.6	1.2	6.3	84.4	5.8	4.2	2.0	0.0	0.6	1.4	29.0	171.0	126.0	21.9	43.8	0.6	39.3
GDAA21	531.9	0.6	1.2	6.3	84.4	5.8	4.2	2.1	0.0	0.6	1.4	29.0	167.4	124.4	21.7	43.3	0.6	39.0
ABAE31	547.1	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.6	130.4	21.7	44.1	0.6	39.1
BBAE31	547.0	0.5	1.2	5.3	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.4	130.4	21.7	44.0	0.6	39.1
CBAE31	547.0	0.5	1.2	5.4	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.0	0.6	39.1
DBAE31	547.4	0.5	1.2	5.4	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	177.6	130.3	21.7	44.0	0.6	39.1
EBAE31	547.6	0.5	1.2	6.0	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	177.1	130.3	21.7	44.0	0.6	39.0
ABAE32	546.7	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.4	130.4	21.7	44.1	0.6	39.0
BBAE32	546.6	0.5	1.2	5.3	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.0	130.4	21.7	44.0	0.6	39.0
CBAE32	546.6	0.5	1.2	5.4	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.0	0.6	39.0
DBAE32	546.9	0.5	1.2	5.4	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.3	130.3	21.7	44.0	0.6	39.0
EBAE32	546.9	0.5	1.2	6.0	84.3	5.5	4.2	2.0	0.0	0.6	1.4	29.0	176.6	130.3	21.7	43.9	0.6	39.0
ABAE33	546.2	0.5	1.2	5.1	84.3	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.1	0.6	39.0
BBAE33	546.1	0.5	1.2	5.2	84.3	4.1	4.2	2.0	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.0	0.6	39.0
CBAE33	546.3	0.5	1.3	5.3	84.3	4.7	4.2	2.0	0.0	0.6	1.4	29.0	177.5	130.3	21.7	44.0	0.6	39.0
DBAE33	546.7	0.5	1.2	5.7	84.3	5.3	4.2	2.0	0.0	0.6	1.4	29.0	176.9	130.3	21.7	44.0	0.6	39.0
EBAE33	546.4	0.5	1.2	6.1	84.4	5.5	4.2	2.0	0.0	0.6	1.4	28.9	176.2	130.3	21.7	43.9	0.6	39.0
ABAE41	547.0	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.6	130.4	21.7	44.1	0.6	39.1
BBAE41	546.9	0.5	1.2	5.3	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.0	0.6	39.1
CBAE41	546.9	0.5	1.2	5.4	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.0	0.6	39.0
DBAE41	547.3	0.5	1.2	5.4	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.5	130.3	21.7	44.0	0.6	39.0
EBAE41	547.6	0.5	1.2	6.0	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	177.1	130.3	21.7	44.0	0.6	39.0
ABAE42	546.6	0.5	1.2	5.2	84.3	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.3	130.4	21.7	44.1	0.6	39.0
BBAE42	546.4	0.5	1.2	5.3	84.3	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.0	130.4	21.7	44.0	0.6	39.0
CBAE42	546.4	0.5	1.2	5.3	84.3	4.3	4.2	2.1	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.0	0.6	39.0
DBAE42	547.2	0.5	1.2	5.9	84.3	5.4	4.2	2.1	0.0	0.6	1.4	29.0	177.0	130.3	21.7	44.0	0.6	39.0
EBAE42	546.6	0.5	1.2	6.0	84.0	5.5	4.2	2.0	0.0	0.6	1.4	29.0	176.7	130.3	21.7	43.9	0.6	39.0
ABAE43	546.2	0.5	1.2	5.1	84.3	4.0	4.2	2.0	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.1	0.6	39.0
BBAE43	546.0	0.5	1.3	5.2	84.3	4.1	4.2	2.0	0.0	0.6	1.4	29.0	177.8	130.4	21.7	44.0	0.6	39.0
CBAE43	546.4	0.5	1.2	5.3	84.3	4.7	4.2	2.0	0.0	0.6	1.4	29.0	177.6	130.3	21.7	44.0	0.6	39.0
DBAE43	546.7	0.5	1.2	5.7	84.3	5.3	4.2	2.0	0.0	0.6	1.4	29.0	177.0	130.3	21.7	44.0	0.6	39.0
EBAE43	546.5	0.5	1.2	6.1	84.3	5.4	4.2	2.0	0.0	0.6	1.4	28.9	176.3	130.3	21.7	43.9	0.6	39.0
ABAE51	547.0	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.5	130.4	21.7	44.1	0.6	39.1

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
BBAE51	546.9	0.5	1.2	5.3	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.0	0.6	39.1
CBAE51	546.9	0.5	1.2	5.4	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.0	0.6	39.0
DBAE51	547.3	0.5	1.2	5.4	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.5	130.4	21.7	44.0	0.6	39.0
EBAE51	547.7	0.5	1.2	6.0	84.4	5.5	4.2	2.0	0.0	0.6	1.4	29.0	177.2	130.4	21.7	44.0	0.6	39.0
ABAE52	546.4	0.5	1.2	5.1	84.3	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.0	0.6	39.0
BBAE52	546.4	0.5	1.3	5.3	84.3	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.0	130.4	21.7	44.0	0.6	39.0
CBAE52	546.6	0.5	1.2	5.4	84.3	4.8	4.2	2.1	0.0	0.6	1.4	29.0	177.6	130.4	21.7	44.0	0.6	39.0
DBAE52	547.3	0.5	1.3	5.9	84.3	5.4	4.2	2.1	0.0	0.6	1.4	29.0	177.1	130.4	21.7	44.0	0.6	39.0
EBAE52	547.2	0.5	1.2	6.0	84.3	5.5	4.2	2.0	0.0	0.6	1.4	29.0	176.9	130.4	21.7	44.0	0.6	39.0
ABAE53	546.0	0.5	1.3	5.1	84.3	4.0	4.2	2.0	0.0	0.6	1.4	29.0	178.0	130.4	21.7	44.0	0.6	39.0
BBAE53	546.0	0.5	1.3	5.2	84.3	4.1	4.2	2.0	0.0	0.6	1.4	29.0	177.8	130.4	21.7	44.0	0.6	39.0
CBAE53	546.2	0.5	1.3	5.3	84.3	4.7	4.2	2.0	0.0	0.6	1.4	29.0	177.4	130.4	21.7	44.0	0.6	39.0
DBAE53	546.7	0.5	1.2	5.7	84.3	5.3	4.2	2.0	0.0	0.6	1.4	29.0	176.9	130.4	21.7	43.9	0.6	39.0
EBAE53	546.9	0.5	1.3	6.0	84.3	5.4	4.2	2.0	0.0	0.6	1.4	28.9	176.7	130.4	21.7	43.9	0.6	39.0
ABAE61	538.2	0.5	1.2	5.2	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	172.2	127.7	21.7	44.0	0.6	39.1
BBAE61	538.2	0.5	1.2	5.3	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	172.1	127.7	21.7	44.0	0.6	39.1
CBAE61	538.0	0.5	1.2	5.4	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	171.8	127.6	21.7	44.0	0.6	39.1
DBAE61	539.2	0.5	1.2	6.0	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	171.4	127.7	21.7	44.0	0.6	39.0
EBAE61	539.2	0.5	1.2	6.0	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	171.2	127.7	21.7	44.0	0.6	39.0
ABAE62	536.4	0.5	1.2	5.1	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	171.1	127.3	21.7	44.0	0.6	39.1
BBAE62	536.5	0.5	1.2	5.3	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	171.0	127.3	21.7	44.0	0.6	39.1
CBAE62	537.2	0.5	1.2	5.3	84.4	5.2	4.2	2.1	0.0	0.6	1.4	29.0	170.6	127.3	21.7	44.0	0.6	39.0
DBAE62	537.5	0.5	1.2	5.9	84.3	5.4	4.2	2.1	0.0	0.6	1.4	29.0	170.3	127.4	21.7	43.9	0.6	39.0
EBAE62	537.6	0.5	1.2	6.1	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	169.9	127.5	21.7	43.9	0.6	39.0
ABAE63	535.5	0.5	1.3	5.1	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	170.4	127.2	21.7	44.0	0.6	39.1
BBAE63	535.4	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	170.1	127.2	21.7	44.0	0.6	39.1
CBAE63	536.1	0.5	1.3	5.3	84.3	4.9	4.2	2.1	0.0	0.6	1.4	29.0	170.1	127.2	21.7	43.9	0.6	39.0
DBAE63	536.3	0.5	1.3	5.3	84.3	5.3	4.2	2.1	0.0	0.6	1.4	29.0	169.8	127.2	21.7	43.9	0.6	39.0
EBAE63	536.3	0.5	1.2	6.0	84.3	5.4	4.2	2.1	0.0	0.6	1.4	29.0	169.0	127.3	21.7	43.9	0.6	39.0
ABAE71	547.2	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.7	130.4	21.7	44.1	0.6	39.0
BBAE71	547.1	0.5	1.2	5.3	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.4	130.4	21.7	44.1	0.6	39.0
CBAE71	547.5	0.5	1.2	5.4	84.4	4.9	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.0	0.6	39.0
DBAE71	547.9	0.5	1.2	5.9	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	177.6	130.3	21.7	44.0	0.6	39.0
EBAE71	547.6	0.5	1.2	6.1	84.3	5.6	4.2	2.1	0.0	0.6	1.4	29.0	177.0	130.3	21.7	44.0	0.6	39.0
ABAE72	546.6	0.5	1.3	5.2	84.3	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.3	130.4	21.7	44.1	0.6	39.0
BBAE72	546.6	0.5	1.2	5.3	84.3	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.0	0.6	39.0
CBAE72	546.9	0.5	1.3	5.4	84.3	4.8	4.2	2.1	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.0	0.6	39.0
DBAE72	547.2	0.5	1.3	5.9	84.3	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.1	130.3	21.7	44.0	0.6	39.0
EBAE72	546.8	0.5	1.2	6.0	84.3	5.5	4.2	2.0	0.0	0.6	1.4	29.0	176.6	130.3	21.7	43.9	0.6	39.0
ABAE73	546.2	0.5	1.3	5.1	84.3	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.2	130.4	21.7	44.1	0.6	39.0
BBAE73	546.1	0.5	1.3	5.2	84.3	4.1	4.2	2.0	0.0	0.6	1.4	29.0	177.9	130.4	21.7	44.0	0.6	39.0
CBAE73	546.0	0.5	1.3	5.3	84.3	4.2	4.2	2.0	0.0	0.6	1.4	29.0	177.7	130.3	21.7	44.0	0.6	39.0
DBAE73	546.8	0.5	1.3	5.9	84.3	5.3	4.2	2.0	0.0	0.6	1.4	29.0	176.9	130.3	21.7	43.9	0.6	39.0
EBAE73	546.7	0.5	1.3	6.0	84.3	5.4	4.2	2.0	0.0	0.6	1.4	29.0	176.7	130.3	21.7	43.9	0.6	39.0

Table 12-1. Average annual water supply value for the Mainstem System over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Lake	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	Omaha Reach	Nebraska City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ABAE81	537.5	0.5	1.2	5.1	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.1	171.8	127.5	21.7	44.0	0.6	39.1
BBAE81	537.6	0.5	1.2	5.3	84.4	4.3	4.2	2.1	0.0	0.6	1.4	29.1	171.7	127.5	21.7	44.0	0.6	39.1
CBAE81	537.5	0.5	1.2	5.4	84.4	4.4	4.2	2.1	0.0	0.6	1.4	29.0	171.5	127.5	21.7	44.0	0.6	39.1
DBAE81	538.6	0.5	1.2	6.0	84.4	5.5	4.2	2.1	0.0	0.6	1.4	29.0	170.9	127.5	21.7	43.9	0.6	39.0
EBAE81	538.1	0.6	1.2	6.2	84.4	5.6	4.2	2.1	0.0	0.6	1.4	29.0	170.1	127.7	21.7	43.9	0.6	39.0
ABAE82	536.3	0.5	1.2	5.1	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	171.0	127.3	21.7	44.0	0.6	39.1
BBAE82	536.4	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	170.9	127.3	21.7	44.0	0.6	39.1
CBAE82	536.9	0.5	1.3	5.3	84.1	5.2	4.2	2.1	0.0	0.6	1.4	29.0	170.5	127.3	21.7	43.9	0.6	39.0
DBAE82	537.5	0.5	1.2	5.8	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	170.3	127.4	21.7	43.9	0.6	39.0
EBAE82	536.0	0.6	1.2	6.1	84.3	5.6	4.2	2.1	0.0	0.6	1.4	28.7	168.5	127.6	21.7	43.9	0.6	39.0
ABAE83	535.4	0.5	1.3	5.1	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	170.3	127.2	21.7	44.0	0.6	39.1
BBAE83	535.4	0.5	1.3	5.2	84.4	4.0	4.2	2.1	0.0	0.6	1.4	29.0	170.2	127.2	21.7	44.0	0.6	39.1
CBAE83	536.1	0.5	1.3	5.3	84.4	4.9	4.2	2.1	0.0	0.6	1.4	29.0	170.0	127.2	21.7	43.9	0.6	39.0
DBAE83	536.5	0.5	1.3	5.8	84.4	5.3	4.2	2.1	0.0	0.6	1.4	29.0	169.6	127.2	21.7	43.9	0.6	39.0
EBAE83	535.2	0.6	1.2	6.2	84.3	5.5	4.2	2.1	0.0	0.6	1.4	29.0	167.6	127.6	21.7	43.9	0.6	38.9
ABAE91	547.1	0.5	1.2	5.2	84.4	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.6	130.4	21.7	44.1	0.6	39.0
BBAE91	547.0	0.5	1.2	5.3	84.4	4.2	4.2	2.1	0.0	0.6	1.4	29.0	178.3	130.4	21.7	44.1	0.6	39.0
CBAE91	547.4	0.5	1.2	5.4	84.4	4.8	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.0	0.6	39.0
DBAE91	547.7	0.5	1.2	5.9	84.4	5.4	4.2	2.1	0.0	0.6	1.4	29.0	177.4	130.3	21.7	44.0	0.6	39.0
EBAE91	547.4	0.5	1.2	6.1	84.3	5.6	4.2	2.1	0.0	0.6	1.4	29.0	176.9	130.3	21.7	44.0	0.6	39.0
ABAE92	546.5	0.5	1.3	5.2	84.3	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.3	130.4	21.7	44.1	0.6	39.0
BBAE92	546.4	0.5	1.3	5.3	84.3	4.1	4.2	2.1	0.0	0.6	1.4	29.0	178.0	130.4	21.7	44.0	0.6	39.0
CBAE92	546.8	0.5	1.3	5.4	84.3	4.7	4.2	2.1	0.0	0.6	1.4	29.0	177.8	130.4	21.7	44.0	0.6	39.0
DBAE92	547.1	0.5	1.3	5.9	84.3	5.3	4.2	2.1	0.0	0.6	1.4	29.0	177.1	130.3	21.7	44.0	0.6	39.0
EBAE92	546.8	0.5	1.2	6.0	84.3	5.4	4.2	2.0	0.0	0.6	1.4	29.0	176.6	130.3	21.7	43.9	0.6	39.0
ABAE93	546.2	0.5	1.3	5.1	84.3	4.0	4.2	2.1	0.0	0.6	1.4	29.0	178.1	130.4	21.7	44.1	0.6	39.0
BBAE93	546.0	0.5	1.3	5.2	84.3	4.1	4.2	2.0	0.0	0.6	1.4	29.0	177.8	130.4	21.7	44.0	0.6	39.0
CBAE93	546.3	0.5	1.3	5.3	84.3	4.7	4.2	2.0	0.0	0.6	1.4	29.0	177.5	130.3	21.7	44.0	0.6	39.0
DBAE93	546.7	0.5	1.3	5.8	84.3	5.3	4.2	2.0	0.0	0.6	1.4	29.0	176.9	130.3	21.7	43.9	0.6	39.0
EBAE93	546.4	0.5	1.2	6.1	84.3	5.4	4.2	2.0	0.0	0.6	1.4	28.9	176.2	130.3	21.7	43.9	0.6	38.9
EVQ2XX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

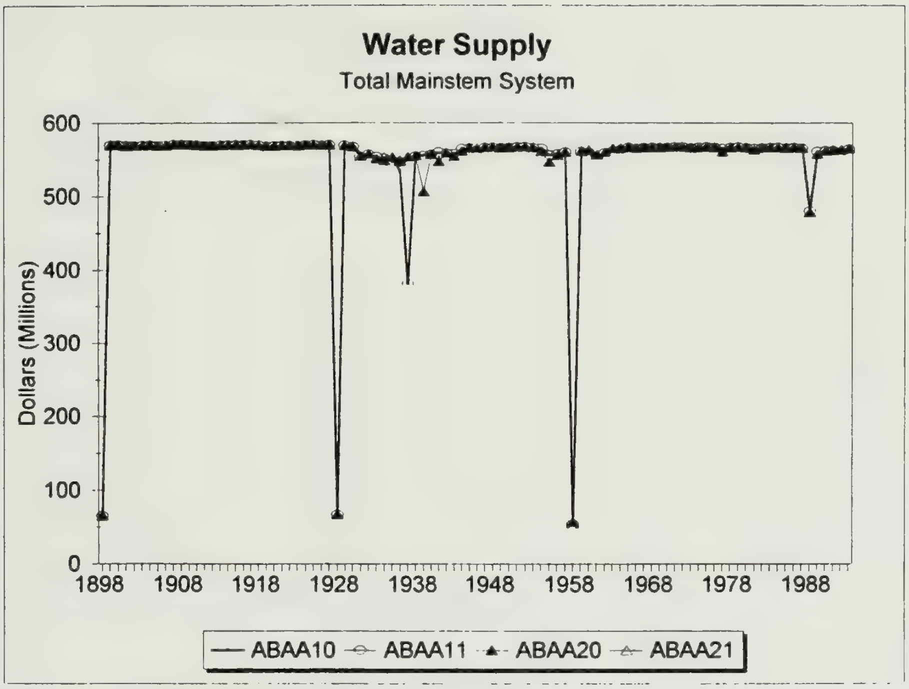

Figure 12-1. Annual water supply benefits of the total Mainstem System over the 93-year simulation period.

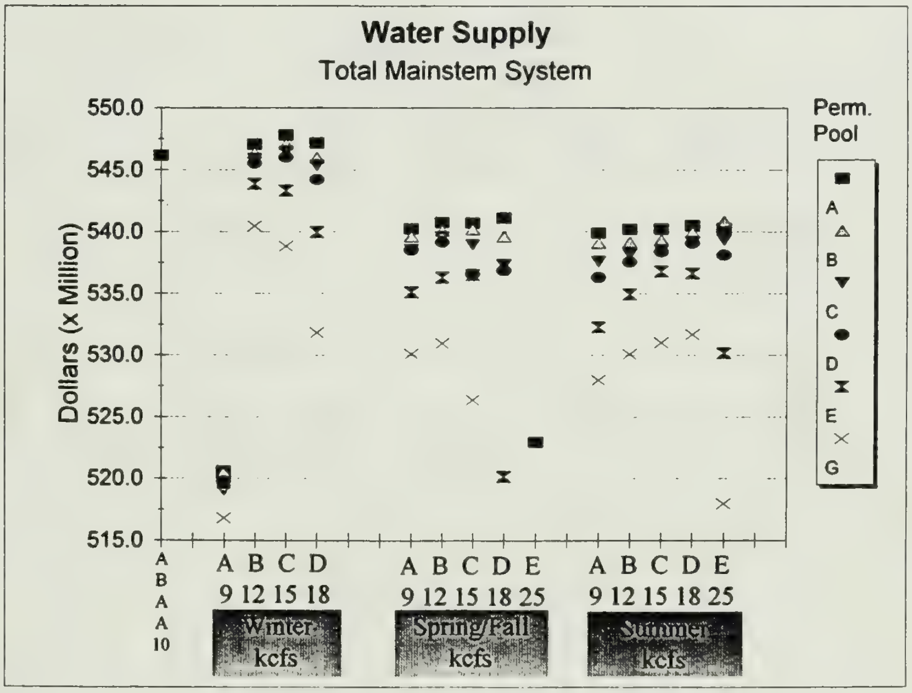

Figure 12-2. Average annual water supply benefits of the Mainstem System by nonnavigation service level.

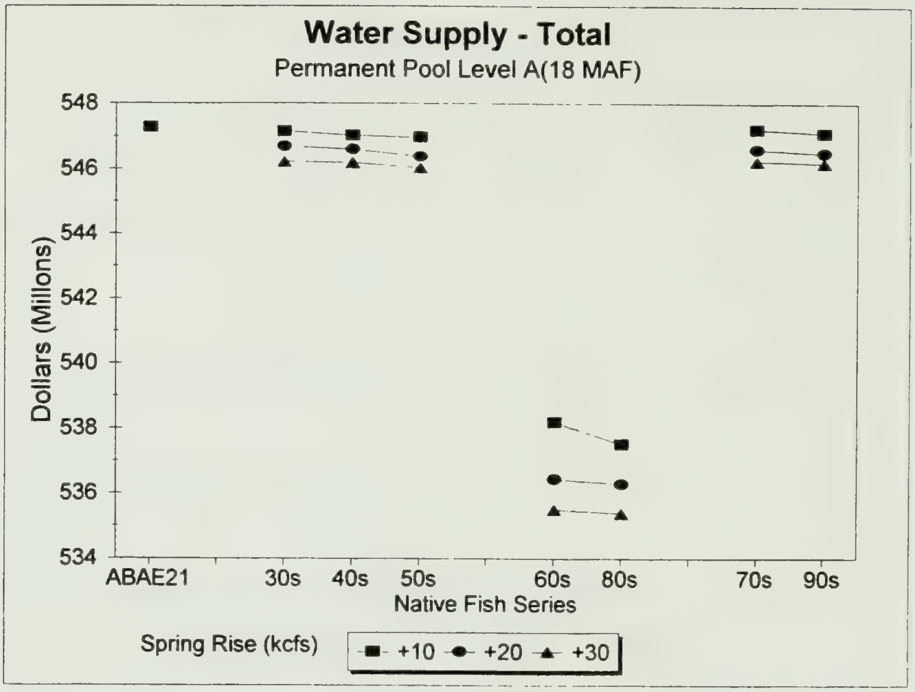

Figure 12-3. Average annual water supply benefits of the Mainstem System by native fish flow level.

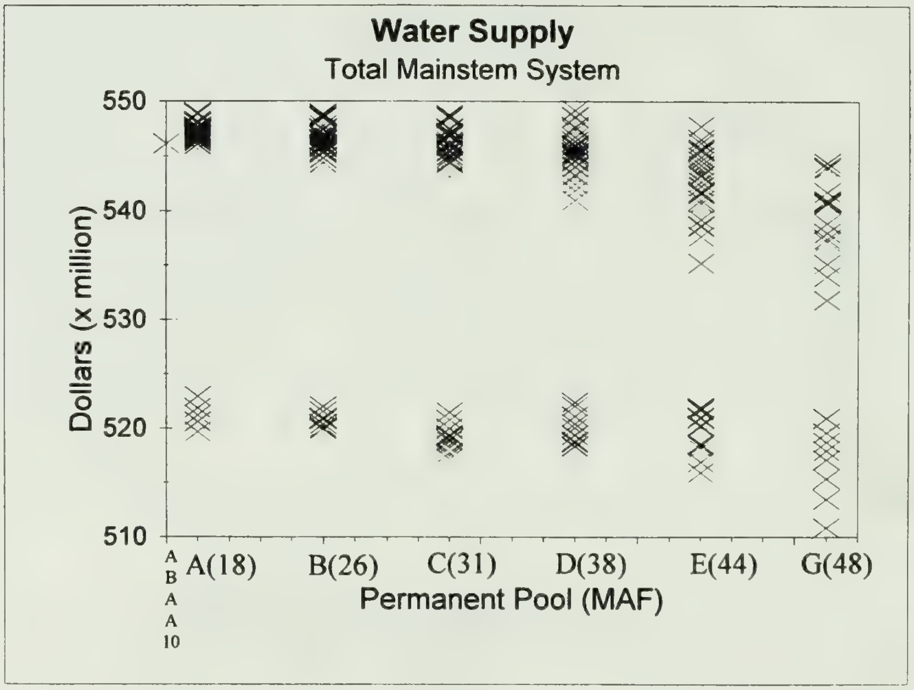

Figure 12-4. Average annual water supply benefits of the Mainstem System by permanent pool level.

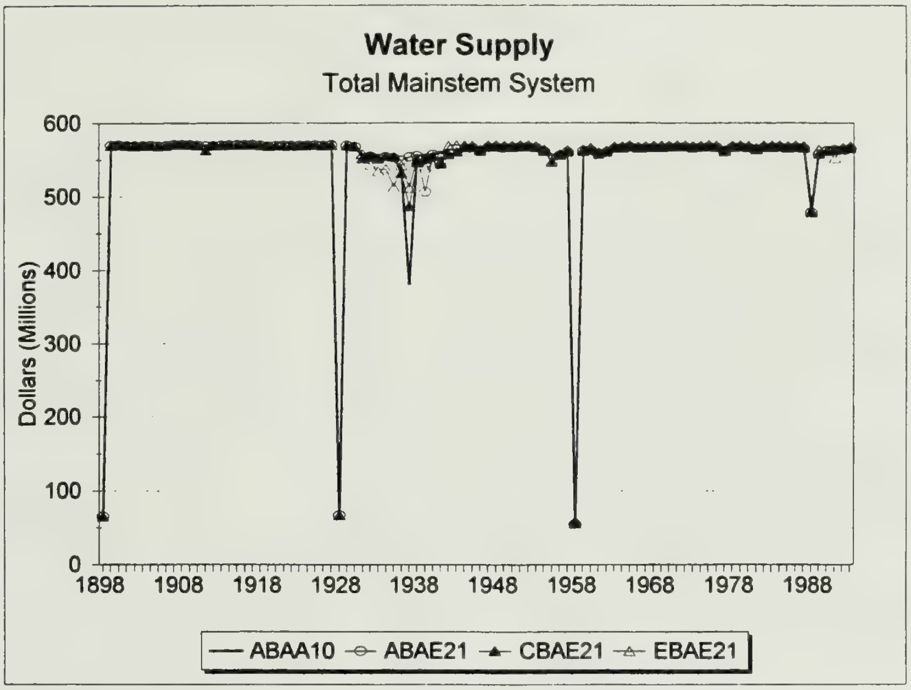

Figure 12-5. Average annual water supply benefits of the Mainstem System by permanent pool level during drought and nondrought years.

13.0 HYDROPOWER

The impacts to the hydropower resource are estimated by evaluating the changes in average annual hydropower value between alternatives. The two components of hydropower value are the capacity value and the energy value. The capacity value reflects the value of the ability of the hydropower units to meet maximum power needs, especially during the summer and winter peak demands. The energy value represents the value of hydropower in minimizing the cost of operating all available plants (hydropower plus thermoelectric power) to meet day-to-day power demands. The NED and direct RED value of hydropower under current operation is $614.9 million per annum. Changes in the Missouri River's Water Control Plans (system operation alternatives) would increase system-wide hydropower production value. Of the alternatives studied, differences in value of hydropower production, measured through direct RED value, are approximately 3-percent between the alternative that yields the highest hydropower value and the existing operations (ABAA10). In summary:

- The modified navigation and intrasystem regulation criteria slightly increase the average system-wide hydropower value compared to existing operations.

- Increasing minimum nonnavigation service level during droughts decreases the system-wide hydropower value.

- Increasing spring service levels with the Native Fish Series to enhance native fish slightly decreases the average system-wide hydropower value.

- Increasing the permanent pool level slightly increases the system-wide hydropower value.

13.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

13.1.1 Effect of the Modified Navigation Criteria

The modified navigation criteria increase average hydropower value by 0.9 percent, from $614 million annually under alternative ABAA10 to $620 million under alternative ABAA20 (Table 13-1). This increase is due to a slight system-wide average increase in monthly pool levels for the 96-year simulation period. The system-wide average increase in pool levels is mainly the result of increased pool levels during drought years (Figure 13-1). Increased pool levels during droughts (e.g., mid-1930s and early 1950s) result in increased hydropower value during the same time.

13.1.2 Effect of Modified Intrasystem Regulation

The average system-wide hydropower value increases by 0.6 percent ($618 million) under alternative ABAA11 compared to alternative ABAA10 ($614 million) (Table 13-1). This increase is due to a system-wide average increase in pool levels, resulting from increased levels during drought periods, which in turn results in an increase in hydropower production value (Figure 13-1).

13.1.3 Combined Effect of the Modified Navigation and Intrasystem Regulation Criteria

The average system-wide hydropower value increases by 1.7 percent ($625 million) under alternative ABAA21 compared to alternative ABAA10 ($614 million) (Table 13-1). The combined effect of the two regimes results in a net increase in average system-wide pool levels; therefore, the resulting increase in the hydropower production value is slightly higher than that associated with each of the two regimes alone (Figure 13-1).

13.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVEL

Increasing minimum nonnavigation service releases from Gavins Point Dam during drought years results in slightly reduced pool levels for alternatives with lower permanent pools. These lower pool levels result in a decreased hydropower value during drought years (Figure 13-2). For example, alternative ABAB21 has a higher hydropower value than alternative ABBB21 because its lower spring release results in higher average pool levels.

As a result of higher permanent pool levels, the monthly flows diminished and there is a corresonding reduction in the hydropower value (Figure 13-2). For example, compared to alternative ABAB21, alternative BBBB21 has a higher hydropower value. This value stems from the increase in the permanent pool level and is greater than its increase in spring release.

13.3 EFFECT OF NATIVE FISH SERIES

All alternatives that provide higher spring flows for native fish slightly reduce hydropower value. Figure 13-3 illustrates the effects when combined with permanent pool level A. The hydropower value drops as spring flow becomes progressively higher. Comparable changes occur at the other permanent pool levels.

The hydropower values resulting from these alternatives are lower than alternative ABAE21. As the spring rise becomes progressively greater, the hydropower value is reduced. Generally, as flood control constraints are reduced, the hydropower value is further reduced. Shortening the navigation season in conjunction with higher flows slightly reduces hydropower value; whereas a split navigation season in conjunction with higher flows increases the hydropower value.

13.4 EFFECT OF PERMANENT POOL LEVEL

With higher permanent pool levels, the hydropower value is correspondingly increased (Figure 13-4). The increase is slightly more pronounced during drought years (Figure 13-5). Average system-wide hydropower value ranges between $625 million under alternative ABAE21 and $633 million under alternative EBAE21 (Table 13-1). This range signifies an increase of 1 percent, which is directly attributable to higher permanent pools.

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Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Poin Dam
ABAA10	614.9	59.2	136.8	179.4	110.4	100.6	28.4
ABAA11	618.7	59.5	135.0	179.9	110.5	100.6	33.4
ABAA20	620.3	59.8	138.9	183.0	110.3	100.0	28.2
AAAA21	627.6	60.5	138.5	185.0	110.5	100.1	33.1
AAAB21	627.6	60.5	138.5	185.0	110.5	100.1	33.1
AAAC21	627.6	60.5	138.5	185.0	110.5	100.1	33.1
AAAD21	627.6	60.5	138.5	185.0	110.5	100.1	33.1
AAAE21	627.6	60.5	138.5	185.0	110.5	100.1	33.1
AABB21	626.5	60.4	138.1	184.3	110.6	100.0	33.1
AABC21	626.5	60.4	138.1	184.3	110.6	100.0	33.1
AABD21	626.5	60.4	138.1	184.3	110.6	100.0	33.1
AABE21	626.5	60.4	138.1	184.3	110.6	100.0	33.1
AACC21	625.3	60.3	137.8	183.5	110.6	100.0	33.1
AACD21	625.3	60.3	137.8	183.5	110.6	100.0	33.1
AACE21	625.3	60.3	137.8	183.5	110.6	100.0	33.1
AADD21	625.3	60.3	137.8	183.7	110.6	99.9	33.1
AADE21	624.7	60.2	137.6	183.3	110.6	99.9	33.1
AAEE21	623.0	60.0	137.5	182.1	110.5	99.9	33.1
ABAA21	625.6	60.4	137.9	183.5	110.6	100.1	33.1
ABAB21	625.6	60.4	137.9	183.5	110.6	100.1	33.1
ABAC21	625.6	60.4	137.9	183.5	110.6	100.1	33.1
ABAD21	625.6	60.4	137.9	183.5	110.6	100.1	33.1
ABAE21	625.6	60.4	137.9	183.5	110.6	100.1	33.1
ABBB21	624.9	60.2	137.7	183.3	110.7	100.0	33.1
ABBC21	624.8	60.2	137.7	183.2	110.7	100.0	33.1
ABBD21	624.7	60.2	137.6	183.1	110.7	100.0	33.1
ABBE21	624.7	60.2	137.7	183.0	110.7	100.0	33.1
ABCC21	624.9	60.2	137.6	183.3	110.7	100.0	33.1
ABCD21	624.7	60.2	137.6	183.1	110.7	100.0	33.1
ABCE21	624.1	60.1	137.4	182.8	110.7	100.0	33.2
ABDD21	624.1	60.1	137.4	182.8	110.7	100.0	33.1
ABDE21	623.4	60.0	137.2	182.4	110.7	100.0	33.2
ACAA21	624.7	60.3	137.6	183.0	110.7	100.1	33.1
ACAB21	624.5	60.3	137.5	182.9	110.7	100.1	33.1
ACAC21	624.7	60.3	137.6	183.0	110.6	100.1	33.1
ACAD21	624.9	60.2	137.7	183.2	110.7	100.0	33.1
ACAE21	624.1	60.2	137.4	182.7	110.7	100.0	33.2

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
ACBB21	624.1	60.1	137.4	182.7	110.7	100.0	33.1
ACBC21	623.7	60.1	137.3	182.5	110.7	100.0	33.1
ACBD21	623.9	60.1	137.4	182.5	110.7	100.0	33.2
ACBE21	623.8	60.1	137.2	182.5	110.7	100.1	33.2
ACCC21	623.9	60.1	137.3	182.6	110.7	100.0	33.1
ACCD21	623.1	60.0	137.0	182.2	110.7	100.0	33.2
ACCE21	623.6	60.1	137.3	182.3	110.7	100.0	33.2
ACDD21	622.8	60.0	137.0	182.0	110.7	100.1	33.1
ACDE21	622.1	59.9	136.8	181.5	110.7	100.0	33.2
ADAA21	624.2	60.2	137.3	182.7	110.7	100.2	33.2
ADAB21	623.9	60.1	137.3	182.4	110.7	100.2	33.2
ADAC21	624.5	60.1	137.6	182.7	110.7	100.2	33.2
ADAD21	624.0	60.1	137.4	182.4	110.7	100.2	33.2
ADAE21	623.9	60.1	137.3	182.3	110.7	100.2	33.2
ADBB21	623.6	60.0	137.4	182.2	110.8	100.1	33.2
ADBC21	623.1	59.9	137.2	181.9	110.8	100.1	33.2
ADBD21	624.2	60.1	137.6	182.4	110.7	100.2	33.2
ADBE21	623.0	59.9	137.2	181.7	110.8	100.2	33.3
ADCC21	623.4	59.9	137.3	182.0	110.8	100.1	33.2
ADCD21	623.2	60.0	137.3	181.8	110.9	100.0	33.2
ADCE21	621.7	59.8	136.8	181.0	110.9	100.0	33.3
ADDD21	622.3	59.8	137.0	181.4	110.9	100.1	33.2
ADDE21	622.2	59.8	137.2	181.2	110.8	100.0	33.3
BAAA21	627.9	60.6	138.6	185.0	110.5	100.1	33.1
BAAB21	627.9	60.6	138.6	185.0	110.5	100.1	33.1
BAAC21	627.9	60.6	138.6	185.0	110.5	100.1	33.1
BAAD21	627.9	60.6	138.6	185.0	110.5	100.1	33.1
BAAE21	627.9	60.6	138.6	185.0	110.5	100.1	33.1
BABB21	628.3	60.7	139.0	185.0	110.5	100.0	33.1
BABC21	628.1	60.7	138.9	184.9	110.5	100.0	33.1
BABD21	627.8	60.7	138.8	184.8	110.5	100.0	33.1
BABE21	627.9	60.7	138.8	184.9	110.5	100.0	33.1
BACC21	627.9	60.6	138.8	184.9	110.5	100.0	33.1
BACD21	627.6	60.6	138.7	184.7	110.6	100.0	33.1
BACE21	627.4	60.6	138.7	184.7	110.5	99.9	33.1
BADD21	626.9	60.5	138.5	184.3	110.6	99.9	33.1
BADE21	627.0	60.5	138.7	184.2	110.5	99.9	33.1

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Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
BBAA21	628.0	60.7	138.7	184.9	110.6	100.0	33.1
BBAB21	628.7	60.6	139.1	185.2	110.6	100.1	33.1
BBAC21	628.3	60.6	138.9	185.1	110.6	100.1	33.1
BBAD21	628.1	60.7	138.8	184.9	110.6	100.0	33.1
BBAE21	627.5	60.6	138.6	184.5	110.6	100.0	33.1
BBBB21	627.4	60.5	138.6	184.5	110.7	100.0	33.1
BBBC21	627.6	60.6	138.6	184.6	110.7	99.9	33.1
BBBD21	627.2	60.6	138.5	184.4	110.7	99.9	33.1
BBBE21	627.8	60.6	138.8	184.5	110.6	100.0	33.1
BBCC21	627.3	60.6	138.6	184.5	110.6	100.0	33.1
BBCD21	627.6	60.6	138.8	184.5	110.7	99.9	33.1
BBCE21	626.8	60.5	138.6	184.0	110.6	100.0	33.1
BBDD21	627.1	60.6	138.7	184.1	110.6	100.0	33.1
BBDE21	626.0	60.4	138.3	183.5	110.7	99.9	33.1
BCAA21	627.1	60.6	138.4	184.3	110.7	100.0	33.1
BCAB21	626.8	60.6	138.3	184.1	110.7	100.0	33.1
BCAC21	626.5	60.5	138.2	183.9	110.7	100.0	33.1
BCAD21	627.1	60.5	138.6	184.1	110.7	100.0	33.1
BCAE21	626.8	60.6	138.5	183.9	110.7	100.1	33.2
BCBB21	627.3	60.6	138.6	184.3	110.7	100.0	33.1
BCBC21	627.6	60.7	138.8	184.3	110.7	100.0	33.1
BCBD21	626.9	60.5	138.6	184.1	110.7	100.0	33.1
BCBE21	626.0	60.4	138.2	183.5	110.7	100.0	33.2
BCCC21	627.6	60.6	139.0	184.2	110.6	100.0	33.0
BCCD21	626.6	60.5	138.6	183.7	110.6	100.0	33.1
BCCE21	627.3	60.6	139.1	183.9	110.6	99.9	33.1
BCDD21	625.6	60.3	138.2	183.3	110.7	100.0	33.1
BCDE21	626.2	60.5	138.6	183.4	110.7	99.9	33.2
BDAA21	627.8	60.8	139.2	183.9	110.7	100.1	33.1
BDAB21	626.7	60.5	138.4	183.9	110.6	100.2	33.1
BDAC21	626.5	60.4	138.4	183.7	110.7	100.1	33.1
BDAD21	627.5	60.6	138.9	184.1	110.6	100.2	33.1
BDAE21	626.3	60.4	138.5	183.4	110.7	100.1	33.2
BDBB21	627.6	60.6	138.9	184.2	110.7	100.1	33.1
BDBC21	626.8	60.5	138.7	183.7	110.7	100.2	33.1
BDBD21	627.4	60.6	138.9	184.0	110.7	100.1	33.1
BDBE21	626.6	60.5	138.8	183.5	110.7	100.0	33.2

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
BDCC21	626.5	60.4	138.6	183.6	110.8	100.1	33.1
BDCD21	625.2	60.2	138.1	182.9	110.8	100.0	33.2
BDCE21	626.3	60.5	138.6	183.3	110.8	99.9	33.2
BDDD21	625.5	60.2	138.3	183.0	110.8	100.0	33.1
CAAA21	629.6	60.9	139.1	186.1	110.4	100.2	33.0
CAAB21	629.4	60.9	139.0	186.0	110.4	100.1	33.0
CAAC21	629.3	60.8	139.0	185.8	110.4	100.1	33.0
CAAD21	629.1	60.8	139.0	185.8	110.4	100.1	33.0
CAAE21	629.2	60.8	139.2	185.7	110.4	100.1	33.1
CABB21	629.6	60.8	139.5	186.1	110.4	100.0	32.9
CABC21	629.6	60.8	139.5	185.9	110.4	100.0	33.0
CABD21	629.5	60.8	139.3	185.9	110.4	100.0	33.0
CABE21	629.2	60.8	139.3	185.6	110.4	100.0	33.1
CACC21	628.6	60.7	139.1	185.4	110.4	100.0	33.0
CACD21	629.0	60.8	139.3	185.6	110.4	100.0	33.0
CACE21	628.3	60.7	139.0	185.2	110.3	100.0	33.1
CADD21	628.4	60.7	139.0	185.4	110.4	99.9	33.0
CADE21	628.3	60.7	139.3	184.9	110.3	99.9	33.1
CBAA21	628.9	60.9	139.2	185.4	110.4	100.1	33.0
CBAB21	629.2	60.8	139.3	185.7	110.4	100.0	33.0
CBAC21	628.9	60.8	139.2	185.4	110.4	100.1	33.0
CBAD21	628.9	60.8	139.2	185.4	110.5	100.1	33.1
CBAE21	628.5	60.8	139.0	185.1	110.4	100.1	33.1
CBBB21	628.5	60.7	139.0	185.2	110.5	100.0	33.0
CBBC21	628.4	60.8	138.9	185.1	110.5	100.0	33.1
CBBD21	628.6	60.8	139.2	185.1	110.5	100.0	33.1
CBBE21	628.8	60.8	139.2	185.2	110.5	100.0	33.1
CBCC21	628.7	60.8	139.1	185.3	110.5	100.0	33.0
CBCD21	628.2	60.7	138.9	185.1	110.5	100.0	33.0
CBCE21	628.4	60.7	139.3	184.8	110.5	100.0	33.1
CBDD21	629.0	60.8	139.3	185.8	110.4	99.8	32.9
CBDE21	627.9	60.7	139.2	184.6	110.5	99.8	33.1
CCAA21	628.5	60.8	138.9	185.2	110.5	100.1	33.0
CCAB21	628.1	60.8	138.8	184.9	110.6	100.0	33.0
CCAC21	627.8	60.8	138.9	184.6	110.6	100.0	33.1
CCAD21	627.8	60.7	138.8	184.6	110.6	100.0	33.1
CCAE21	628.4	60.8	139.2	184.8	110.5	100.1	33.1

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Poin Dam
CCBB21	628.6	60.9	139.1	185.2	110.6	100.0	33.0
CCBC21	628.4	60.8	139.1	184.9	110.5	100.1	33.1
CCBD21	628.0	60.7	139.0	184.6	110.6	100.0	33.1
CCBE21	628.6	60.8	139.3	184.9	110.5	100.0	33.1
CCCC21	628.6	60.8	139.3	184.9	110.6	100.0	33.0
CCCD21	629.5	60.9	139.7	185.6	110.5	99.9	32.9
CCCE21	628.5	60.9	139.5	184.6	110.6	99.9	33.1
CCDD21	628.9	60.8	139.8	184.9	110.5	99.9	33.0
CDAA21	628.7	60.9	139.0	185.1	110.6	100.1	33.0
CDAB21	628.2	60.8	138.9	184.7	110.6	100.1	33.1
CDAC21	628.3	60.8	139.1	184.6	110.6	100.1	33.1
CDAD21	628.7	60.7	139.3	184.8	110.6	100.1	33.1
CDAE21	628.4	60.8	139.3	184.5	110.5	100.1	33.2
CDBB21	628.3	60.8	139.1	184.8	110.5	100.1	33.0
CDBC21	628.1	60.7	139.1	184.5	110.6	100.1	33.1
CDBD21	628.7	60.7	139.5	185.0	110.6	100.0	33.0
CDBE21	628.5	60.8	139.5	184.4	110.6	100.0	33.2
CDCC21	628.0	60.6	139.2	184.4	110.7	100.0	33.1
CDCD21	628.7	60.8	139.7	184.7	110.6	99.9	33.0
CDDD21	627.8	60.7	139.3	184.3	110.6	100.0	33.0
DAAA21	631.5	61.1	140.0	187.1	110.4	100.0	32.9
DAAB21	631.4	61.1	140.1	186.9	110.4	100.0	32.9
DAAC21	631.3	61.1	140.1	186.9	110.4	100.0	32.9
DAAD21	631.4	61.2	139.9	187.1	110.4	99.9	32.9
DAAE21	631.1	61.1	140.1	186.6	110.4	99.9	33.0
DABB21	631.2	61.1	139.8	187.1	110.4	99.9	32.9
DABC21	630.8	61.1	139.6	186.8	110.4	99.9	32.9
DABD21	632.7	61.5	141.4	186.5	110.6	99.8	32.9
DABE21	630.8	61.1	140.1	186.7	110.2	99.8	32.9
DACC21	631.4	61.1	140.0	187.2	110.4	99.8	32.8
DACD21	631.4	61.1	140.1	187.2	110.4	99.8	32.8
DACE21	631.1	61.1	140.6	186.6	110.3	99.7	32.9
DADD21	631.3	61.0	140.5	186.8	110.3	99.7	32.8
DBAA21	631.8	61.1	140.3	187.3	110.3	100.0	32.8
DBAB21	631.8	61.1	140.4	187.2	110.4	99.9	32.8
DBAC21	631.6	61.1	140.1	187.1	110.4	99.9	32.9
DBAD21	631.6	61.1	140.2	187.1	110.4	99.9	32.9

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
DBAE21	630.8	61.0	140.1	186.4	110.4	99.9	33.0
DBBB21	631.2	61.0	140.1	186.8	110.5	99.9	32.9
DBBC21	631.4	61.1	140.2	186.9	110.4	99.9	32.9
DBBD21	630.8	61.0	140.1	186.6	110.4	99.8	32.9
DBBE21	631.5	61.2	140.6	186.7	110.4	99.7	33.0
DBCC21	630.6	61.0	140.0	186.4	110.5	99.8	32.9
DBCD21	631.7	61.1	140.7	187.0	110.4	99.7	32.8
DBDD21	631.2	61.2	140.3	186.9	110.3	99.7	32.8
DCAA21	631.6	61.1	140.4	186.9	110.4	99.9	32.8
DCAB21	631.3	61.1	140.3	186.6	110.5	99.9	32.9
DCAC21	631.6	61.1	140.5	186.7	110.5	99.9	32.9
DCAD21	631.0	61.1	140.3	186.4	110.5	99.9	32.9
DCAE21	631.6	61.2	140.8	186.5	110.5	99.7	33.0
DCBB21	630.8	61.0	140.0	186.7	110.4	99.8	32.8
DCBC21	630.5	61.0	140.0	186.4	110.4	99.8	32.8
DCBD21	630.5	61.1	140.1	186.1	110.5	99.8	32.9
DCBE21	632.5	61.1	141.2	187.0	110.4	99.8	33.0
DCCC21	631.7	61.1	140.8	186.7	110.5	99.7	32.8
DCCD21	631.9	61.1	140.9	186.8	110.5	99.8	32.8
DCDD21	632.2	61.0	141.1	187.3	110.3	99.8	32.7
DDAA21	630.7	61.0	139.9	186.6	110.4	99.8	32.8
DDAB21	632.2	61.2	141.0	187.1	110.3	99.9	32.7
DDAC21	631.5	61.1	140.7	186.6	110.5	99.8	32.8
DDAD21	631.4	61.1	140.7	186.4	110.5	99.8	32.9
DDAE21	632.7	61.2	141.5	186.7	110.4	99.8	33.0
DDBB21	630.6	61.0	140.3	186.2	110.5	99.8	32.8
DDBC21	631.1	61.1	140.7	186.2	110.6	99.8	32.8
DDBD21	632.0	61.2	141.0	186.6	110.5	99.8	32.9
DDCC21	631.6	61.1	140.9	186.6	110.5	99.8	32.7
DDCD21	632.6	61.1	141.4	187.2	110.3	99.8	32.7
EAAA21	634.2	61.1	140.8	189.4	109.8	100.3	32.6
EAAB21	633.9	61.2	140.8	189.2	109.9	100.2	32.7
EAAC21	633.6	61.2	140.8	188.7	110.0	100.0	32.7
EAAD21	633.3	61.2	140.6	188.6	110.2	99.9	32.8
EAAE21	632.8	61.2	140.8	187.8	110.2	99.9	32.9
EABB21	633.5	61.2	140.7	189.0	109.8	100.2	32.6
EABC21	633.1	61.2	140.6	188.4	110.2	99.9	32.7

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Poin Dam
EABD21	633.7	61.2	141.2	188.5	110.1	99.9	32.8
EABE21	632.9	61.2	141.2	187.6	110.2	99.7	32.9
EACC21	632.4	61.1	140.6	187.8	110.2	99.8	32.7
EACD21	633.1	61.2	141.2	187.8	110.2	99.9	32.8
EADD21	632.0	61.2	140.6	187.6	110.1	99.7	32.7
EBAA21	633.9	61.2	141.1	188.9	109.8	100.3	32.7
EBAB21	633.7	61.2	140.7	188.9	110.0	100.2	32.7
EBAC21	634.1	61.2	141.1	188.8	110.2	100.1	32.7
EBAD21	632.7	61.1	140.7	187.8	110.3	99.9	32.8
EBAE21	633.2	61.3	141.2	187.7	110.3	99.8	32.9
EBBB21	633.7	61.1	140.9	188.9	110.1	100.1	32.7
EBBC21	633.5	61.2	141.2	188.3	110.2	99.9	32.7
EBBD21	633.0	61.2	141.0	187.8	110.2	99.9	32.8
EBCC21	633.2	61.2	141.0	188.3	110.2	99.9	32.7
EBCD21	632.7	61.2	141.0	187.6	110.3	99.8	32.8
ECAA21	633.5	61.1	141.2	188.5	110.0	100.1	32.6
ECAB21	633.5	61.2	141.0	188.5	110.1	100.0	32.7
ECAC21	633.7	61.2	141.4	188.1	110.3	100.0	32.7
ECAD21	633.7	61.2	141.3	188.2	110.2	99.9	32.8
ECBB21	633.2	61.1	141.3	187.9	110.3	99.9	32.7
ECBC21	633.4	61.1	141.2	188.2	110.2	99.9	32.7
ECBD21	633.4	61.2	141.3	187.8	110.4	99.9	32.8
ECCC21	633.9	61.1	141.4	188.5	110.3	100.0	32.6
ECCD21	633.6	61.1	141.4	188.3	110.2	99.9	32.7
EDAA21	633.9	61.2	141.1	189.1	110.0	100.1	32.5
EDAB21	634.5	61.2	141.4	189.1	110.1	100.1	32.5
EDAC21	633.7	61.1	141.3	188.5	110.2	100.1	32.6
EDBB21	633.6	61.1	141.3	188.6	110.1	100.1	32.5
EDBC21	633.9	61.1	141.5	188.3	110.3	100.0	32.6
EDBD21	634.1	61.2	141.9	188.3	110.3	99.8	32.7
EDCC21	633.9	61.1	141.9	188.2	110.2	99.9	32.6
GAAA21	634.8	61.2	141.4	190.0	110.0	99.8	32.4
GAAB21	635.1	61.2	140.9	190.5	110.1	100.0	32.4
GAAC21	635.0	61.2	140.9	190.3	110.2	99.9	32.5
GAAD21	635.2	61.3	141.6	189.7	110.2	99.9	32.6
GAAE21	634.5	61.4	141.3	189.4	110.1	99.7	32.7
GABB21	635.5	61.0	141.3	190.8	110.2	99.9	32.3

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
GABC21	635.2	61.0	141.1	190.6	110.2	99.8	32.4
GABD21	634.9	61.0	141.3	190.2	110.2	99.8	32.5
GACC21	634.6	61.0	141.0	190.2	110.3	99.7	32.4
GACD21	634.5	61.0	141.4	189.7	110.2	99.6	32.5
GBAA21	635.0	61.1	140.9	190.6	110.2	100.0	32.3
GBAB21	635.2	61.0	141.0	190.6	110.4	99.9	32.4
GBAC21	635.1	61.0	141.0	190.4	110.4	99.8	32.5
GBAD21	634.8	61.0	141.1	190.0	110.4	99.8	32.6
GBBB21	635.3	61.0	141.3	190.7	110.4	99.8	32.3
GBBC21	634.7	61.0	140.9	190.0	110.5	99.8	32.5
GBBD21	634.7	61.1	141.4	189.6	110.5	99.6	32.6
GBCC21	635.1	60.9	141.7	189.9	110.6	99.6	32.4
GCAA21	635.3	61.0	141.2	190.8	110.1	100.0	32.2
GCAB21	635.6	60.9	141.4	190.6	110.4	100.0	32.3
GCAC21	635.5	60.9	141.5	190.3	110.5	99.9	32.4
GCAD21	635.2	61.0	141.7	189.8	110.5	99.7	32.5
GCBB21	635.5	60.9	141.5	190.4	110.6	99.9	32.3
GDAA21	635.0	60.9	141.1	190.4	110.3	100.0	32.2
ABAE31	623.3	59.3	135.2	184.2	110.5	100.2	33.9
BBAE31	625.2	59.5	135.9	185.2	110.5	100.2	33.9
CBAE31	626.6	59.8	136.5	185.8	110.4	100.2	33.8
DBAE31	628.4	60.1	136.9	187.1	110.3	100.1	33.8
EBAE31	630.2	60.4	137.6	188.3	110.2	100.0	33.7
ABAE32	620.0	59.3	133.9	182.9	110.7	99.6	33.6
BBAE32	622.7	59.6	135.0	184.3	110.6	99.6	33.6
CBAE32	623.5	59.8	135.4	184.6	110.6	99.6	33.5
DBAE32	625.3	60.1	136.2	185.6	110.6	99.4	33.5
EBAE32	628.0	60.5	137.1	187.4	110.4	99.2	33.3
ABAE33	615.3	59.1	132.1	181.1	110.9	98.8	33.3
BBAE33	618.1	59.5	133.4	182.4	110.8	98.7	33.3
CBAE33	619.7	59.9	134.0	183.2	110.7	98.7	33.2
DBAE33	622.8	60.2	135.3	184.9	110.7	98.6	33.2
EBAE33	625.4	60.5	136.8	186.1	110.8	98.3	32.9
ABAE41	622.2	59.2	134.2	183.8	110.7	100.3	33.9
BBAE41	624.6	59.5	135.1	185.1	110.7	100.3	33.9
CBAE41	625.5	59.7	135.6	185.4	110.6	100.3	33.9
DBAE41	627.4	60.0	136.3	186.6	110.6	100.2	33.8

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
EBAE41	629.2	60.3	136.9	187.7	110.6	100.0	33.7
ABAE42	618.9	59.2	133.2	182.4	110.9	99.6	33.6
BBAE42	621.3	59.5	134.1	183.7	110.8	99.5	33.6
CBAE42	622.4	59.8	134.7	184.0	110.8	99.5	33.6
DBAE42	625.7	60.2	136.0	186.0	110.7	99.3	33.5
EBAE42	627.0	60.4	136.3	187.0	110.6	99.2	33.4
ABAE43	614.9	59.1	132.0	180.8	110.9	98.7	33.3
BBAE43	617.4	59.4	133.1	182.1	110.9	98.7	33.3
CBAE43	619.7	59.8	134.2	183.0	110.9	98.6	33.3
DBAE43	622.5	60.2	135.3	184.6	110.8	98.4	33.2
EBAE43	624.6	60.5	136.8	185.4	110.8	98.2	32.9
ABAE51	622.1	59.1	134.2	183.3	111.0	100.5	34.0
BBAE51	625.1	59.4	135.3	184.9	111.0	100.5	34.0
CBAE51	626.1	59.7	135.8	185.2	111.0	100.5	33.9
DBAE51	628.0	60.0	136.2	186.6	110.9	100.4	33.9
EBAE51	630.6	60.3	137.4	188.0	110.9	100.3	33.8
ABAE52	619.8	59.2	133.5	182.5	111.0	99.8	33.7
BBAE52	621.1	59.4	133.9	183.3	111.0	99.8	33.6
CBAE52	623.3	59.8	134.8	184.3	111.0	99.8	33.6
DBAE52	625.9	60.2	135.8	185.8	110.9	99.7	33.5
EBAE52	627.1	60.5	136.0	186.8	111.1	99.4	33.4
ABAE53	615.2	59.1	132.1	180.8	111.0	98.8	33.3
BBAE53	616.9	59.4	132.9	181.6	111.1	98.7	33.3
CBAE53	619.3	59.8	133.6	182.9	111.1	98.7	33.2
DBAE53	622.1	60.2	134.8	184.3	111.2	98.5	33.1
EBAE53	623.7	60.5	135.0	185.6	111.2	98.4	33.0
ABAE61	624.6	59.2	135.3	185.2	110.5	100.7	33.8
BBAE61	626.3	59.5	136.2	185.8	110.4	100.6	33.7
CBAE61	627.4	59.7	136.4	186.5	110.4	100.6	33.7
DBAE61	630.0	60.1	137.3	188.4	110.3	100.3	33.6
EBAE61	630.7	60.4	137.6	188.9	110.2	100.1	33.5
ABAE62	619.9	59.2	132.9	183.6	110.5	100.2	33.5
BBAE62	622.0	59.5	133.8	184.6	110.5	100.1	33.4
CBAE62	623.9	60.0	134.4	185.8	110.5	99.9	33.4
DBAE62	625.9	60.3	135.4	186.9	110.4	99.6	33.3
EBAE62	627.5	60.4	136.7	187.5	110.3	99.5	33.1
ABAE63	616.8	59.2	132.5	181.8	110.7	99.3	33.2

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Point Dam
BBAE63	620.0	59.7	133.8	183.4	110.7	99.2	33.2
CBAE63	621.0	60.0	134.1	183.9	110.7	99.1	33.2
DBAE63	622.3	60.3	134.5	185.0	110.6	98.9	33.1
EBAE63	624.6	60.7	136.0	186.2	110.4	98.5	32.8
ABAE71	623.7	59.3	135.0	184.6	110.6	100.5	33.8
BBAE71	625.6	59.5	135.8	185.6	110.6	100.4	33.7
CBAE71	627.0	59.8	136.3	186.2	110.5	100.4	33.7
DBAE71	629.0	60.1	137.0	187.4	110.4	100.4	33.6
EBAE71	630.9	60.4	137.8	188.7	110.4	100.1	33.5
ABAE72	619.5	59.4	133.2	183.3	110.6	99.7	33.3
BBAE72	621.2	59.6	133.8	184.2	110.6	99.6	33.3
CBAE72	622.5	59.9	134.4	184.8	110.6	99.5	33.3
DBAE72	624.5	60.3	134.9	186.1	110.5	99.5	33.2
EBAE72	626.6	60.5	135.9	187.4	110.5	99.2	33.1
ABAE73	615.5	59.3	132.3	181.3	110.8	98.7	33.0
BBAE73	617.9	59.6	133.2	182.6	110.8	98.6	33.0
CBAE73	618.6	59.9	133.6	182.8	110.8	98.5	33.0
DBAE73	621.9	60.3	135.0	184.7	110.7	98.3	32.9
EBAE73	622.7	60.5	135.2	185.3	110.9	98.0	32.8
ABAE81	624.3	59.2	134.7	185.1	110.8	100.7	33.8
BBAE81	626.0	59.5	135.6	185.7	110.7	100.7	33.8
CBAE81	627.2	59.7	135.9	186.4	110.8	100.6	33.8
DBAE81	630.0	60.2	137.0	188.4	110.6	100.2	33.6
EBAE81	631.9	60.2	138.7	189.1	110.5	100.1	33.3
ABAE82	619.8	59.3	132.7	183.4	110.8	100.2	33.5
BBAE82	621.8	59.6	133.3	184.5	110.8	100.1	33.5
CBAE82	623.9	60.1	134.0	185.7	110.8	99.9	33.4
DBAE82	625.6	60.2	134.9	186.6	110.8	99.7	33.4
EBAE82	628.3	60.3	137.3	188.5	110.4	99.2	32.7
ABAE83	615.9	59.2	131.8	181.5	110.9	99.3	33.3
BBAE83	617.0	59.5	133.1	181.0	110.9	99.3	33.2
CBAE83	620.1	59.9	133.3	183.8	110.9	99.1	33.2
DBAE83	621.2	60.1	133.9	184.6	110.7	98.9	33.1
EBAE83	625.9	60.4	137.1	187.6	110.5	98.1	32.3
ABAE91	623.7	59.2	134.9	184.4	110.9	100.5	33.8
BBAE91	625.8	59.5	135.8	185.4	110.9	100.4	33.8
CBAE91	627.2	59.8	136.4	186.0	110.9	100.4	33.8

Table 13-1. Average annual hydropower value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Dam	Garrison Dam	Oahe Dam	Big Bend Dam	Fort Randall Dam	Gavins Poin Dam
DBAE91	629.3	60.1	137.0	187.4	110.7	100.4	33.7
EBAE91	631.3	60.4	137.6	188.7	110.8	100.3	33.6
ABAE92	619.4	59.4	133.2	182.9	110.8	99.8	33.4
BBAE92	621.0	59.6	133.7	183.9	110.8	99.6	33.3
CBAE92	622.2	59.9	134.2	184.5	110.8	99.5	33.3
DBAE92	624.5	60.3	134.9	185.8	110.8	99.5	33.2
EBAE92	626.9	60.5	135.9	187.2	110.8	99.3	33.2
ABAE93	614.9	59.3	131.9	181.0	111.0	98.7	33.1
BBAE93	617.4	59.6	132.9	182.4	111.0	98.6	33.0
CBAE93	619.1	59.9	133.7	183.0	110.9	98.5	33.0
DBAE93	621.5	60.3	134.6	184.5	111.0	98.3	32.9
EBAE93	624.1	60.7	136.1	185.5	110.9	98.1	32.7
Evq2XX	0.0	0.0	0.0	0.0	0.0	0.0	0.0

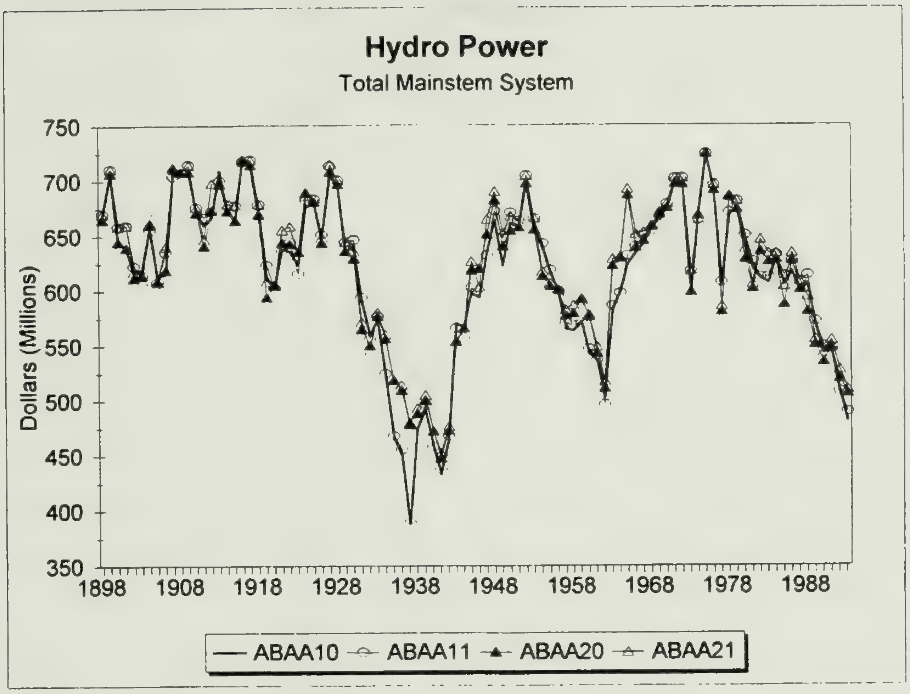

Figure 13-1. Annual hydropower benefits of the total Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

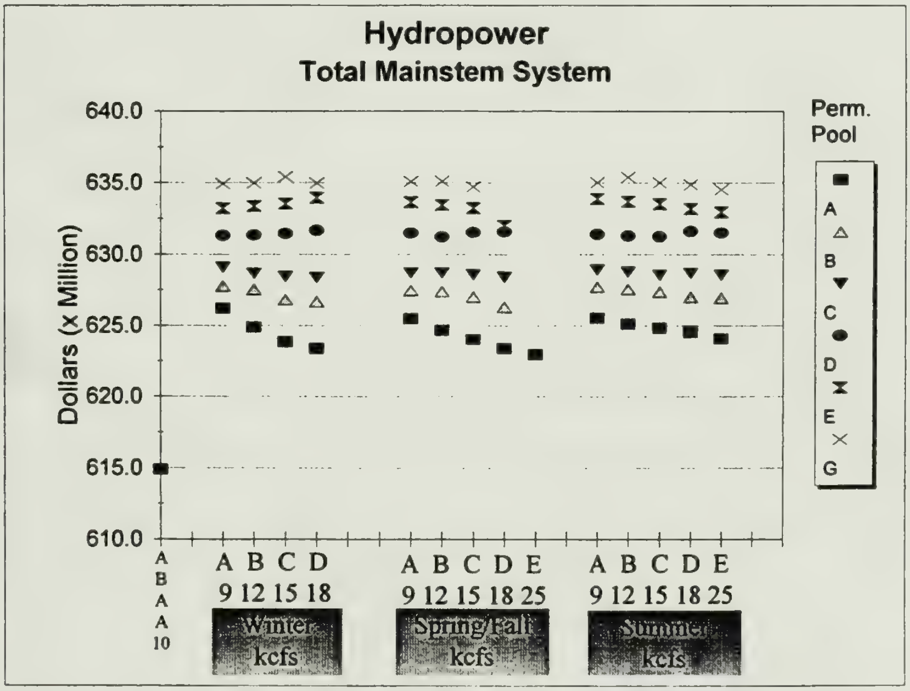

Figure 13-2. Average annual hydropower benefits of the Mainstem System by nonnavigation service level.

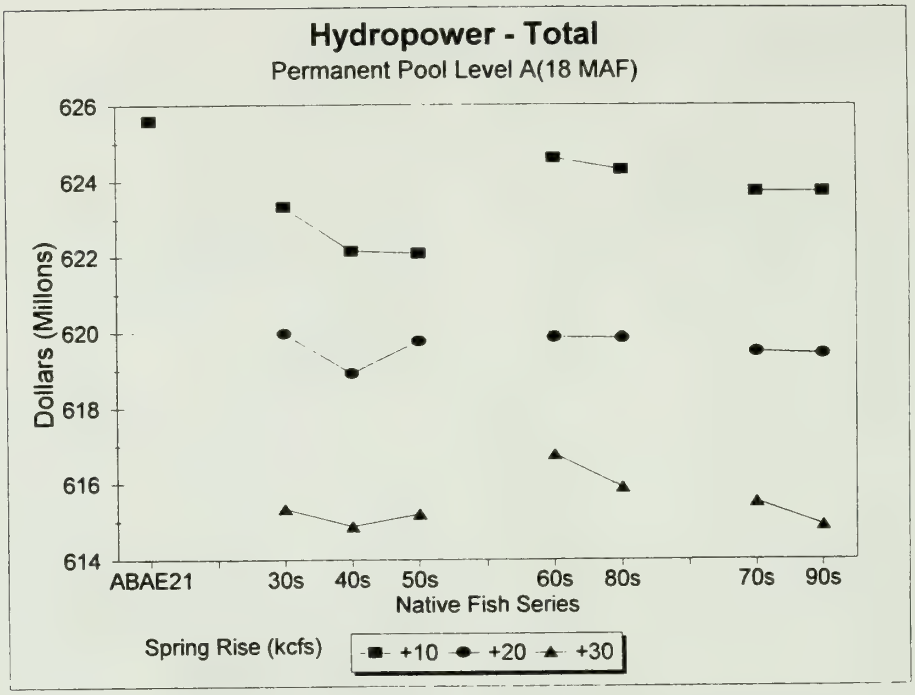

Figure 13-3. Average annual hydropower benefits of the Mainstem System by the Native Fish alternatives and degree of flood control.

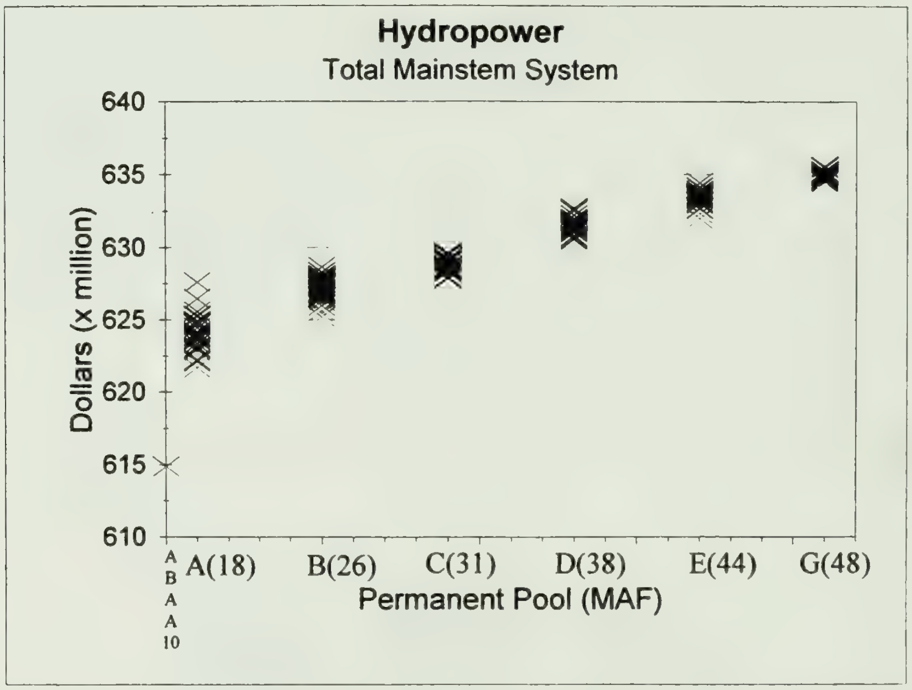

Figure 13-4. Average annual hydropower benefits of the Mainstem System by permanent pool level.

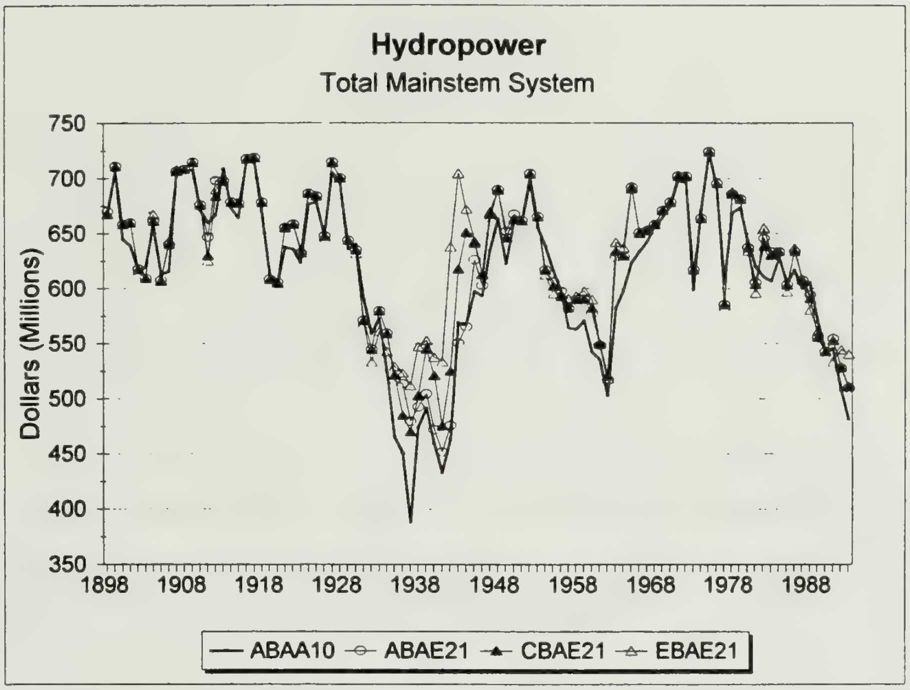

Figure 13-5. Annual hydropower benefits of the total Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAE21, CBAE21, and EBAE21.

14.0 RECREATION

Changes in the current Water Control Plan would affect recreation use levels on the lakes and the river reaches. Lake elevations and river flows below the six mainstem dams are the primary criteria used in assessing potential changes in recreation use levels in each lake and on selected location points along the river. Lake levels and river flows below the six mainstem dams vary considerably among the system operation alternatives. Within the range of alternatives, difference in level of recreation use measured through total expenditures associated with each system operation alterative, is approximately 6 percent between highest and lowest. In summary:

- The modified navigation and intrasystem regulation criteria slightly increases average system-wide recreation value compared to the existing operations.
- Increasing minimum nonnavigation service level during droughts negligibly affects average system-wide recreation value.
- Increasing spring service levels to enhance native fish slightly decreases average system-wide recreation value.
- Increasing the permanent pool levels increases average system-wide recreation value.

14.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

14.1.1 Effect of the Modified Navigation Criteria

The modified navigation criteria increase the river's average recreation value by about 3.5 percent from $75.7 million annually under alternative ABAA10 to $78.5 million under alternative ABAA20 (Table 14-1).

On average, based on the 96-year simulation period, the modified navigation criteria increases recreation value in the three upper mainstem lakes, while causing negligible changes in other lakes and some lower river reaches. Fort Peck Lake, Lake Sakakawea, and Lake Oahe experience 13 percent, 14 percent, and 6 percent increases in recreation values, respectively. These increases in recreation value result from releases at these lakes being reduced at the onset of a drought, thus avoiding large reductions of reservoir storage and more quickly restoring volumes at the end of a major drought. While this scenario results in increases in upstream storage and therefore recreation value, it reduces recreation value at Lake Francis Case by 1.7 percent, because it experiences a quicker drawdown and takes longer to recover its storage compared to the three major upstream reservoirs. Any changes in other upper river lakes or reaches are considered negligible.

Discharge from Gavins Point is lowered earlier in the drought period thereby reducing downstream flow. However, these reductions occur primarily between October and

November, which are not high recreation use months; therefore, reduction in recreation value downstream is negligible. For example, the largest reduction in recreation value occurs in the reach between Sioux City and St. Joseph. The total reduction in recreation value in this reach is 0.5 percent.

Therefore, the overall increase in average lake recreation value over the 96-year simulation period is a result of lower reductions in recreation value during drought periods in the three upper mainstem lakes. Because reductions in the elevations of these three lakes during droughts are not as severe as during existing operations, the subsequent fall in recreation use during droughts is correspondingly lower (Figure 14-1).

14.1.2 Effect of Modified Intrasystem Regulation

Although the average system-wide recreation value falls by less than 0.5 percent ($75.4 million) under alternative ABAA11 compared to alternative ABAA10 ($75.7 million) (Table 14-1), there are differences in the effects on individual lakes. Specifically, over the 96-year simulation period, Lake Sakakawea experiences a 6-percent increase, while Lake Oahe experiences an 8-percent decrease in average recreation value. Within the 3-year cycle proposed by this alternative, Lake Oahe undergoes drawdowns in the first and third years and is recharged in the second year. Lake Sakakawea experiences increased elevations in the first and third years while experiencing a drawdown in the second year. Because Lake Oahe experiences more annual recreation days than any other upper river lake or reach, the proportional impact of its drawdown on total recreation value is amplified. This fact is highlighted in the 96-year simulation (Figure 14-1). The associated decrease in recreation value is a result of overlap in timing of the drawdown in Lake Oahe, with droughts in the 1930s and 1980s. The result is a 3-year period in the 1930s and a 1-year period in the 1980s in which recreation value is lower than existing operations. Changes in recreation value associated with other lakes and reaches in the upper river and reaches in the lower river are considered negligible.

14.1.3 Combined Effect of the Modified Navigation and Intrasystem Regulation Criteria

Average system-wide recreation value increases by 2.5 percent ($77.6 million) under alternative ABAA21 ($77.6 million) compared to alternative ABAA10 ($75.7 million) (Table 14-1). The combined impact of the two regimes is slightly lower than that of the modified navigation criteria because it is offset by the slight reduction caused by modified intrasystem regulation. Specifically, while Fort Peck Lake and Lake Sakakawea experience increases in recreation value, which are comparable to those experienced under the modified navigation criteria, Lake Oahe's recreation value is similar to that of existing operations (ABAA10) because the reduction it experiences under modified intrasystem regulation is largely offset by the increase with the modified navigation criteria.

14.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

Increasing minimum nonnavigation service level releases from Gavins Point Dam during drought years results in negligible changes in system-wide recreation value (Figure 14-2). While permanent pool levels remain the same as during existing operations

(ABAA10), increases in minimum nonnavigation service levels result in negligible differences in system-wide recreation value. As permanent pool levels are increased, system-wide recreation value correspondingly increases.

14.3 EFFECT OF NATIVE FISH SERIES

As spring flows for native fish increase, the system-wide recreation value slightly decreases under current flood control constraint. Figure 13-3 illustrates the effects when combined with permanent pool level A. Relatively comparable changes occur at different permanent pool levels. For permanent pool levels, the recreation value resulting from implementation of different flood control constraints is relatively consistent along the same flows. Any fluctuations, along similar flows under different flood control constraints, are minimal because they are less than 1 percent.

Compared to alternative ABAE21, eliminating navigation releases in conjunction with higher flows during August and September slightly reduces recreation value. As these flows increase, recreation is further reduced compared to alternative ABAE21 (Figure 14-3). This is not the case when navigation releases are eliminated during October and November. Under these circumstances recreation values are comparable to that of alternative ABAE21. During August and to a lesser degree September, there is considerably higher levels of recreation use than October and November. Therefore, the impact on recreation use resulting from shortening of the navigation season combined with increased flows, which in turn reduce average lake levels, are slightly amplified in August and September compared to October and November.

14.4 EFFECT OF PERMANENT POOL LEVEL

Increasing the permanent pool criteria increases system-wide recreation value (Figure 14-4). During the 96-year simulation period, the overall increase in average lake recreation value is caused by lower reductions in recreation value during drought periods in the three upper mainstem lakes. Because reductions in the elevations of these lakes during droughts are not as severe as during existing operations, the subsequent fall in recreation use during droughts is correspondingly lower (Figure 14-5).

The only deviation occurs during the drought of the 1930s (Figure 14-5). A less significant deviation occurs during the drought of the 1980s. During the droughts of the 1930s and 1980s, recreation value under alternative ABAE21 is lower than ABAA10 because its permanent pool levels are the same as those of existing operations (ABAA10). Therefore, the effect of overlap in timing of the drawdown in Lake Oahe combined with effects from the drought results in a temporary reduction in system-wide recreation value compared to existing operations. Because Lake Oahe experiences more annual recreation days than any other upper river lake or reach, the proportional impact of its drawdown is amplified. As permanent pool levels are increased in subsequent alternatives, the reduction in elevation is offset at Lake Oahe as a result of permitting an unbalanced system.

The upper three reservoirs (Fort Peck Lake, Lake Sakakawea, and Lake Oahe) vary the most in terms of recreation value as a result of changes in permanent pool levels (Table

14-1). As permanent pool levels increase, their respective recreation values correspondingly increase. Increased permanent pool levels in the upper mainstem lakes would slightly reduce lake levels and flows throughout the remainder of the upper and lower river system. Consequently, the remaining lakes and reaches along the upper river system and river reaches located below Gavins Point Dam collectively experience slightly lower recreational benefits. Along the lower river reaches, the number of nonnavigation years increases below Gavins Point Dam. Therefore, reaches below the dam experience an increase in the number of years in which flows do not support navigation and as a result do not support the use of boat ramps and recreation flows. Thus, average annual benefits to recreation along the lower river decrease. However, the decrease in recreation value in this portion of the river is not great enough to offset the increased values in recreation associated with the three upper reservoirs.

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ABAA10	75.7	2.6	0.3	12.3	2.8	13.5	7.1	9.7	0.9	9.1	4.5	10.1	0.6	0.8	0.6	0.9
ABAA11	75.4	2.6	0.3	13.1	2.8	12.4	7.1	9.7	0.9	9.1	4.5	10.2	0.6	0.8	0.6	0.9
ABAA20	78.5	2.9	0.3	14.1	2.8	14.3	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
AAAA21	78.7	3.0	0.3	14.4	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AAAB21	78.7	3.0	0.3	14.4	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AAAC21	78.7	3.0	0.3	14.4	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AAAD21	78.7	3.0	0.3	14.4	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AAAE21	78.7	3.0	0.3	14.4	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AABB21	78.2	2.9	0.3	14.3	2.8	13.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AABC21	78.2	2.9	0.3	14.3	2.8	13.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AABD21	78.2	2.9	0.3	14.3	2.8	13.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AABE21	78.2	2.9	0.3	14.3	2.8	13.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AACC21	77.5	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AACD21	77.5	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AACE21	77.5	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AADD21	77.7	2.9	0.3	14.1	2.8	13.6	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
AADE21	78.0	2.9	0.3	14.1	2.8	13.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
AAEE21	76.5	2.8	0.3	13.5	2.8	13.0	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ABAA21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABAB21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABAC21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABAD21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABAE21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABBB21	77.1	2.9	0.3	13.7	2.8	13.4	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABBC21	77.1	2.9	0.3	13.7	2.8	13.4	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABBD21	77.0	2.9	0.3	13.6	2.8	13.3	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABBE21	77.2	2.9	0.3	13.5	2.8	13.7	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABCC21	77.1	2.9	0.3	14.1	2.8	13.1	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABCD21	77.3	2.8	0.3	14.1	2.8	13.4	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABCE21	77.2	2.8	0.3	14.0	2.8	13.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ABDD21	77.2	2.8	0.3	14.0	2.8	13.3	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ABDE21	77.0	2.8	0.3	13.9	2.8	13.1	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACAA21	77.0	2.9	0.3	14.1	2.8	12.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACAB21	76.9	2.9	0.3	14.0	2.8	12.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACAC21	77.1	2.9	0.3	14.1	2.8	13.0	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

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ACAD21	77.6	2.9	0.3	14.1	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACAE21	77.7	2.8	0.3	14.0	2.8	13.7	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACBB21	76.8	2.8	0.3	14.0	2.8	12.8	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACBC21	77.0	2.8	0.3	13.9	2.8	13.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACBD21	77.0	2.8	0.3	14.0	2.8	13.1	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACBE21	77.6	2.8	0.3	14.0	2.8	13.6	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACCC21	75.9	2.8	0.3	13.2	2.8	12.9	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ACCD21	76.0	2.7	0.3	13.1	2.8	13.1	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ACCE21	77.2	2.8	0.3	13.6	2.8	13.6	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ACDD21	75.6	2.8	0.3	13.2	2.8	12.6	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
ACDE21	76.8	2.8	0.3	13.6	2.8	13.3	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADAA21	76.2	2.8	0.3	13.3	2.8	13.0	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADAB21	76.0	2.8	0.3	13.3	2.8	12.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADAC21	76.3	2.8	0.3	13.4	2.8	13.0	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ADAD21	76.0	2.8	0.3	13.3	2.8	12.9	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADAE21	77.3	2.8	0.3	13.7	2.8	13.7	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADBB21	75.8	2.7	0.3	13.2	2.8	12.8	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ADBC21	75.5	2.7	0.3	13.1	2.8	12.6	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ADBD21	76.4	2.8	0.3	13.3	2.8	13.3	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
ADBE21	76.1	2.8	0.3	13.2	2.8	13.0	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADCC21	76.1	2.7	0.3	13.2	2.8	13.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
ADCD21	76.3	2.7	0.3	13.2	2.8	13.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
ADCE21	75.5	2.8	0.3	13.4	2.8	12.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
ADDD21	76.0	2.8	0.3	12.9	2.8	13.3	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
ADDE21	76.7	2.8	0.3	13.2	2.8	13.5	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BAAA21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BAAB21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BAAC21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BAAD21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BAAE21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BABB21	78.4	3.0	0.3	14.3	2.8	14.0	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BABC21	78.3	3.0	0.3	14.3	2.8	14.0	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BABD21	78.5	3.0	0.3	14.2	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BABE21	78.8	3.0	0.3	14.2	2.8	14.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BACC21	78.3	2.9	0.3	14.2	2.8	14.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9

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BACD21	78.2	2.9	0.3	14.1	2.8	14.0	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BACE21	78.4	2.9	0.3	14.1	2.8	14.3	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BADD21	77.9	2.9	0.3	14.1	2.8	13.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BADE21	78.2	2.9	0.3	13.9	2.8	14.4	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BBAA21	78.4	3.0	0.3	14.5	2.8	13.8	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
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BBAC21	78.5	3.0	0.3	14.3	2.8	14.2	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BBAD21	78.4	3.0	0.3	14.2	2.8	14.1	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBAE21	78.1	2.9	0.3	13.8	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBBB21	78.1	2.9	0.3	14.2	2.8	13.9	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BBBC21	78.0	2.9	0.3	14.2	2.8	13.8	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBBD21	77.7	2.9	0.3	14.1	2.8	13.7	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBBE21	77.8	2.9	0.3	13.9	2.8	13.9	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBCC21	78.1	2.9	0.3	13.9	2.8	14.2	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BBCD21	78.4	2.9	0.3	13.9	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BBCE21	78.1	2.9	0.3	13.8	2.8	14.3	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BBDD21	77.8	2.9	0.3	13.8	2.8	14.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BBDE21	77.5	2.8	0.3	13.7	2.8	13.9	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
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BCAC21	77.5	2.9	0.3	14.0	2.8	13.5	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BCAD21	77.5	2.9	0.3	14.0	2.8	13.5	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BCAE21	77.8	2.9	0.3	14.0	2.8	13.7	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BCBB21	78.2	3.0	0.3	13.9	2.8	14.2	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BCBC21	78.0	3.0	0.3	13.9	2.8	14.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BCBD21	78.0	2.9	0.3	13.8	2.8	14.1	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BCBE21	77.7	2.8	0.3	13.7	2.8	14.0	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BCCC21	77.7	2.9	0.3	13.8	2.8	14.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BCCD21	77.4	2.9	0.3	13.8	2.8	13.7	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BCCE21	78.7	2.9	0.3	14.3	2.8	14.3	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BCDD21	77.6	2.9	0.3	13.7	2.8	13.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BCDE21	77.9	2.9	0.3	14.0	2.8	13.8	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BDAA21	78.2	3.0	0.3	14.0	2.8	14.2	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BDAB21	77.9	2.9	0.3	13.8	2.8	14.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDAC21	77.6	2.9	0.3	13.8	2.8	13.9	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
BDAD21	77.7	2.9	0.3	13.9	2.8	14.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDAE21	78.1	3.0	0.3	13.7	2.8	14.2	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BDBB21	78.2	3.0	0.3	14.1	2.8	14.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDBC21	77.6	2.9	0.3	13.9	2.8	13.8	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDBD21	78.2	3.0	0.3	14.0	2.8	14.2	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDBE21	78.2	2.9	0.3	14.1	2.8	14.0	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
BDCC21	77.7	3.0	0.3	13.8	2.8	14.0	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDCD21	77.3	2.9	0.3	13.6	2.8	13.8	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BDCE21	78.5	3.0	0.3	14.3	2.8	14.2	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
BDDD21	77.9	2.9	0.3	13.8	2.8	14.3	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CAAA21	79.5	3.0	0.3	14.8	2.8	14.6	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CAAB21	79.4	3.0	0.3	14.8	2.8	14.6	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CAAC21	79.2	3.0	0.3	14.6	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CAAD21	79.4	3.0	0.3	14.6	2.8	14.7	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CAAE21	79.0	3.0	0.3	14.3	2.8	14.7	7.1	9.5	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
CABB21	79.5	3.1	0.3	14.8	2.7	14.6	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CABC21	79.0	3.1	0.3	14.5	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CABD21	79.2	3.1	0.3	14.5	2.8	14.7	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CABE21	79.1	3.0	0.3	14.4	2.7	14.7	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CACC21	78.8	3.0	0.3	14.3	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CACD21	78.9	3.0	0.3	14.4	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CACE21	78.8	3.0	0.3	14.3	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CADD21	79.1	3.0	0.3	14.3	2.8	14.8	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CADE21	78.7	3.0	0.3	14.3	2.7	14.3	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBAA21	78.9	3.0	0.3	14.4	2.8	14.3	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CBAB21	79.0	3.0	0.3	14.4	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBAC21	78.8	3.0	0.3	14.4	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBAD21	79.0	3.0	0.3	14.4	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CBAE21	79.0	3.0	0.3	14.3	2.8	14.6	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
CBBB21	78.8	3.0	0.3	14.3	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBBC21	78.8	3.0	0.3	14.3	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBBD21	78.6	3.0	0.3	14.3	2.8	14.3	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBBE21	79.1	3.0	0.3	14.4	2.8	14.6	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CBCC21	78.8	3.1	0.3	14.4	2.8	14.3	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBCD21	78.8	3.0	0.3	14.3	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
CBCE21	78.5	3.0	0.3	14.4	2.8	14.1	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CBDD21	79.5	3.1	0.3	14.6	2.8	14.8	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CBDE21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCAA21	78.9	3.0	0.3	14.3	2.8	14.5	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCAB21	78.7	3.0	0.3	14.3	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCAC21	78.4	3.0	0.3	14.2	2.8	14.2	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CCAD21	78.3	3.0	0.3	14.2	2.8	14.1	7.1	9.5	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CCAE21	78.9	3.0	0.3	14.3	2.8	14.5	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
CCBB21	79.0	3.0	0.3	14.6	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCBC21	78.5	3.0	0.3	14.3	2.8	14.2	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCBD21	78.5	3.0	0.3	14.2	2.8	14.3	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCBE21	79.0	3.0	0.3	14.5	2.8	14.4	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CCCC21	78.2	3.0	0.3	14.2	2.8	14.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCCD21	79.3	3.1	0.3	14.5	2.8	14.8	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCCE21	79.1	3.0	0.3	14.4	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CCDD21	78.8	3.0	0.3	14.3	2.8	14.6	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CDAA21	79.1	3.1	0.3	14.6	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDAB21	78.8	3.0	0.3	14.5	2.8	14.2	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDAC21	78.3	3.0	0.3	14.2	2.8	14.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDAD21	78.5	3.0	0.3	14.2	2.8	14.2	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDAE21	79.0	3.0	0.3	14.3	2.8	14.5	7.1	9.6	0.9	9.1	4.5	10.1	0.5	0.8	0.6	0.9
CDBB21	78.7	3.0	0.3	14.3	2.8	14.4	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDBC21	78.1	3.0	0.3	14.2	2.8	13.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDBD21	79.2	3.1	0.3	14.4	2.8	14.7	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDBE21	79.1	3.0	0.3	14.4	2.8	14.4	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
CDCC21	78.6	3.0	0.3	14.1	2.8	14.5	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CDCD21	78.8	3.1	0.3	14.2	2.8	14.7	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CDDD21	79.1	3.0	0.3	14.4	2.8	14.7	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DAAA21	80.2	3.1	0.3	15.1	2.7	15.0	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DAAB21	80.1	3.1	0.3	14.9	2.7	15.0	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DAAC21	79.7	3.1	0.3	14.6	2.7	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DAAD21	80.2	3.1	0.3	15.1	2.7	14.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DAAE21	79.9	3.1	0.3	14.7	2.7	15.0	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
DABB21	79.9	3.1	0.3	14.9	2.8	14.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DABC21	79.8	3.1	0.3	14.8	2.8	14.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DABD21	79.6	3.1	0.3	14.5	2.8	14.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DABE21	79.7	3.1	0.3	14.8	2.7	14.8	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DACC21	80.1	3.1	0.3	14.9	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DACD21	80.1	3.2	0.3	15.0	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DACE21	80.1	3.1	0.3	15.0	2.7	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DADD21	80.0	3.1	0.3	14.9	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBAA21	80.2	3.1	0.3	15.0	2.8	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBAB21	80.4	3.2	0.3	15.3	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBAC21	80.2	3.2	0.3	15.0	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBAD21	80.2	3.2	0.3	15.0	2.8	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBAE21	79.7	3.1	0.3	14.8	2.7	14.6	7.1	9.6	0.9	9.1	4.4	10.1	0.5	0.8	0.6	0.9
DBBB21	79.9	3.1	0.3	14.8	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBBC21	80.1	3.1	0.3	14.9	2.8	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBBD21	79.8	3.1	0.3	14.8	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBBE21	80.2	3.1	0.3	15.0	2.7	15.0	7.1	9.7	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DBCC21	79.8	3.1	0.3	14.8	2.8	14.9	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBCD21	80.0	3.1	0.3	14.9	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBDD21	79.9	3.1	0.3	14.9	2.7	15.0	7.1	9.7	0.9	9.1	4.3	9.9	0.5	0.8	0.6	0.9
DCAA21	80.0	3.1	0.3	14.9	2.8	14.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCAB21	79.8	3.1	0.3	14.7	2.8	14.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCAC21	79.8	3.1	0.3	14.7	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCAD21	79.7	3.1	0.3	14.6	2.8	14.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCAE21	80.0	3.1	0.3	14.8	2.7	14.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCBB21	79.8	3.1	0.3	14.8	2.8	14.9	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DCBC21	79.6	3.1	0.3	14.7	2.7	14.9	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DCBD21	79.6	3.1	0.3	14.6	2.7	14.9	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCBE21	80.4	3.2	0.3	15.1	2.8	15.0	7.1	9.7	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DCCC21	79.6	3.1	0.3	14.6	2.7	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DCCD21	79.9	3.1	0.3	14.8	2.7	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DCDD21	80.3	3.2	0.3	15.2	2.8	15.1	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
DDAA21	79.7	3.1	0.3	14.7	2.8	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DDAB21	79.8	3.1	0.3	14.8	2.8	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DDAC21	79.6	3.1	0.3	14.7	2.8	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DDAD21	79.6	3.1	0.3	14.6	2.7	15.0	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
DDAE21	80.7	3.1	0.3	15.2	2.8	15.2	7.1	9.7	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DDBB21	79.4	3.1	0.3	14.5	2.7	14.9	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DDBC21	79.5	3.1	0.3	14.6	2.7	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DDBD21	80.0	3.2	0.3	14.9	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DDCC21	79.8	3.1	0.3	14.8	2.7	15.0	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
DDCD21	80.5	3.2	0.3	15.3	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EAAA21	80.3	3.2	0.3	15.3	2.8	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EAAB21	80.4	3.2	0.3	15.3	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EAAC21	80.4	3.2	0.3	15.2	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EAAD21	80.3	3.2	0.3	15.2	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EAAE21	80.2	3.2	0.3	15.0	2.7	15.1	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
EABB21	80.3	3.2	0.3	15.2	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EABC21	80.1	3.2	0.3	15.0	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EABD21	80.2	3.2	0.3	15.1	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EABE21	80.4	3.2	0.3	15.2	2.7	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
EACC21	80.1	3.2	0.3	15.0	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EACD21	80.1	3.2	0.3	15.0	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EADD21	80.2	3.2	0.3	15.1	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAA21	80.3	3.2	0.3	15.2	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAB21	80.3	3.2	0.3	15.1	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAC21	80.4	3.2	0.3	15.3	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAD21	80.1	3.2	0.3	14.9	2.8	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
EBAE21	80.5	3.2	0.3	15.2	2.7	15.1	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
EBBB21	80.4	3.2	0.3	15.3	2.8	15.1	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EBBC21	80.3	3.2	0.3	15.1	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBBD21	80.1	3.2	0.3	15.0	2.8	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBCC21	80.3	3.2	0.3	15.2	2.7	15.1	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EBCD21	80.1	3.2	0.3	15.0	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECAA21	80.7	3.2	0.3	15.5	2.8	15.2	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECAB21	80.4	3.2	0.3	15.2	2.8	15.2	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECAC21	80.2	3.2	0.3	15.1	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECAD21	80.4	3.2	0.3	15.3	2.7	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECBB21	80.3	3.2	0.3	15.2	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECBC21	80.4	3.2	0.3	15.3	2.8	15.1	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
ECBD21	80.4	3.2	0.3	15.4	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ECCC21	80.7	3.2	0.3	15.5	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
ECCD21	80.8	3.2	0.3	15.5	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EDAA21	81.1	3.2	0.3	15.7	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EDAB21	80.8	3.2	0.3	15.6	2.8	15.3	7.1	9.7	0.8	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EDAC21	80.8	3.2	0.3	15.5	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EDBB21	80.8	3.2	0.3	15.5	2.8	15.4	7.1	9.7	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EDBC21	80.7	3.2	0.3	15.5	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EDBD21	80.9	3.2	0.3	15.5	2.8	15.3	7.1	9.7	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EDCC21	161.3	6.4	0.6	31.0	5.5	30.7	14.2	19.4	1.7	18.2	8.5	19.4	1.1	1.6	1.3	1.7
GAAA21	80.8	3.2	0.3	15.6	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.9	0.5	0.8	0.6	0.9
GAAB21	80.6	3.2	0.3	15.5	2.8	15.2	7.1	9.6	0.8	9.1	4.3	9.8	0.5	0.8	0.6	0.9
GAAC21	80.7	3.2	0.3	15.5	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
GAAD21	80.4	3.2	0.3	15.4	2.7	15.1	7.1	9.5	0.9	9.1	4.3	9.9	0.5	0.8	0.6	0.9
GAAE21	80.7	3.2	0.3	15.4	2.8	15.2	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
GABB21	80.9	3.2	0.3	15.8	2.8	15.3	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GABC21	80.8	3.2	0.3	15.7	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GABD21	80.9	3.2	0.3	15.7	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
GACC21	80.8	3.2	0.3	15.7	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GACD21	80.8	3.2	0.3	15.6	2.8	15.3	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GBAA21	80.8	3.2	0.3	15.7	2.8	15.4	7.1	9.5	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GBAB21	81.0	3.2	0.3	15.8	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GBAC21	81.0	3.2	0.3	15.8	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GBAD21	81.0	3.2	0.3	15.7	2.8	15.4	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
GBBB21	81.0	3.2	0.3	15.9	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.9
GBBC21	80.9	3.2	0.3	15.7	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.9
GBBD21	80.9	3.2	0.3	15.7	2.8	15.4	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
GBCC21	80.8	3.2	0.3	15.7	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.8
GCAA21	81.1	3.2	0.3	15.9	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.8
GCAB21	81.1	3.2	0.3	15.9	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.8
GCAC21	81.0	3.2	0.3	15.8	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.8
GCAD21	81.0	3.2	0.3	15.8	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.7	0.5	0.8	0.6	0.8
GCBB21	81.0	3.2	0.3	15.8	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.8
GDAA21	81.2	3.2	0.3	16.0	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.8
ABAE31	77.8	2.9	0.3	14.2	2.8	13.9	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
BBAE31	78.3	3.0	0.3	13.8	2.8	14.6	7.1	9.5	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9
CBAE31	78.9	3.0	0.3	14.2	2.8	14.7	7.1	9.6	0.9	9.1	4.4	10.0	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DBAE31	79.9	3.1	0.3	14.8	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAE31	80.2	3.2	0.3	15.0	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ABAE32	77.5	2.9	0.3	14.0	2.8	14.0	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
BBAE32	78.4	3.0	0.3	14.1	2.8	14.6	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
CBAE32	78.3	3.0	0.3	13.8	2.8	14.8	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
DBAE32	79.4	3.1	0.3	14.4	2.8	15.2	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EBAE32	79.9	3.2	0.3	14.8	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
ABAE33	77.2	2.9	0.3	13.8	2.8	13.9	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
BBAE33	78.0	2.9	0.3	13.9	2.8	14.6	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
CBAE33	78.3	3.0	0.3	14.1	2.8	14.6	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
DBAE33	79.5	3.1	0.3	14.6	2.8	15.2	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EBAE33	80.1	3.2	0.3	15.0	2.8	15.6	7.1	9.5	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
ABAE41	78.0	2.9	0.3	14.2	2.8	14.0	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
BBAE41	78.8	3.0	0.3	14.3	2.8	14.7	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CBAE41	78.7	3.0	0.3	14.0	2.8	14.8	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBAE41	79.7	3.1	0.3	14.6	2.8	15.1	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAE41	80.3	3.2	0.3	15.0	2.8	15.3	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
ABAE42	77.5	2.9	0.3	14.0	2.8	14.0	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
BBAE42	78.2	2.9	0.3	14.0	2.8	14.7	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
CBAE42	78.5	3.0	0.3	14.0	2.8	14.8	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
DBAE42	79.7	3.1	0.3	14.6	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EBAE42	80.0	3.2	0.3	14.9	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
ABAE43	77.1	2.9	0.3	13.7	2.8	13.9	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
BBAE43	77.9	2.9	0.3	13.8	2.8	14.6	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
CBAE43	78.5	3.0	0.3	13.9	2.8	15.0	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
DBAE43	79.6	3.1	0.3	14.6	2.8	15.3	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EBAE43	80.0	3.2	0.3	14.9	2.8	15.6	7.1	9.5	0.9	9.1	4.2	9.6	0.5	0.8	0.6	0.9
ABAE51	77.5	2.9	0.3	14.1	2.8	13.7	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
BBAE51	78.5	2.9	0.3	14.2	2.8	14.5	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CBAE51	79.1	3.0	0.3	14.3	2.8	14.9	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBAE51	80.0	3.1	0.3	14.7	2.8	15.4	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
EBAE51	80.6	3.2	0.3	15.0	2.8	15.6	7.1	9.6	0.9	9.1	4.4	9.8	0.5	0.8	0.6	0.9
ABAE52	77.6	2.9	0.3	14.0	2.8	14.0	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
BBAE52	78.1	2.9	0.3	13.9	2.8	14.7	7.1	9.5	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
CBAE52	78.7	3.0	0.3	14.0	2.8	15.0	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DBAE52	79.9	3.2	0.3	14.6	2.8	15.5	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
EBAE52	80.0	3.2	0.3	14.9	2.8	15.5	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
ABAE53	77.3	2.9	0.3	13.8	2.8	13.9	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
BBAE53	77.4	2.9	0.3	13.4	2.8	14.6	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
CBAE53	78.3	3.0	0.3	13.9	2.8	14.9	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
DBAE53	79.4	3.1	0.3	14.5	2.8	15.3	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
EBAE53	79.8	3.2	0.3	14.7	2.8	15.5	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
ABAE61	76.6	2.8	0.3	13.6	2.8	13.7	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
BBAE61	77.5	2.9	0.3	14.0	2.8	14.1	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
CBAE61	78.6	3.0	0.3	14.3	2.8	14.8	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
DBAE61	79.6	3.1	0.3	14.7	2.8	15.3	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
EBAE61	80.2	3.2	0.3	15.2	2.8	15.4	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
ABAE62	76.0	2.7	0.3	13.3	2.8	13.6	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
BBAE62	77.8	3.0	0.3	13.8	2.8	14.7	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
CBAE62	78.6	3.1	0.3	14.1	2.8	15.1	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
DBAE62	79.2	3.1	0.3	14.5	2.8	15.3	7.1	9.7	0.8	9.1	4.1	9.4	0.5	0.8	0.6	0.9
EBAE62	79.9	3.2	0.3	15.0	2.8	15.5	7.1	9.7	0.8	9.1	4.1	9.3	0.5	0.8	0.6	0.9
ABAE63	75.9	2.8	0.3	13.1	2.8	13.8	7.1	9.7	0.8	9.1	4.1	9.4	0.5	0.8	0.6	0.9
BBAE63	77.5	3.0	0.3	13.7	2.8	14.6	7.1	9.7	0.8	9.1	4.1	9.4	0.5	0.8	0.6	0.9
CBAE63	78.3	3.1	0.3	14.0	2.8	15.0	7.1	9.7	0.8	9.1	4.1	9.4	0.5	0.8	0.6	0.9
DBAE63	79.1	3.1	0.3	14.5	2.8	15.3	7.1	9.7	0.8	9.1	4.1	9.3	0.5	0.8	0.6	0.9
EBAE63	79.7	3.2	0.3	14.9	2.8	15.6	7.1	9.7	0.8	9.1	4.1	9.3	0.5	0.8	0.6	0.8
ABAE71	78.0	2.9	0.3	14.3	2.8	14.0	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
BBAE71	78.4	2.9	0.3	14.3	2.8	14.4	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CBAE71	79.0	3.0	0.3	14.4	2.8	14.8	7.1	9.6	0.9	9.1	4.3	9.9	0.5	0.8	0.6	0.9
DBAE71	80.0	3.1	0.3	14.9	2.8	15.2	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
EBAE71	80.6	3.2	0.3	15.3	2.8	15.3	7.1	9.6	0.8	9.1	4.3	9.8	0.5	0.8	0.6	0.9
ABAE72	77.7	2.9	0.3	14.2	2.8	14.1	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
BBAE72	78.1	2.9	0.3	14.1	2.8	14.5	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
CBAE72	78.6	3.0	0.3	14.2	2.8	14.9	7.1	9.6	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
DBAE72	79.5	3.1	0.3	14.7	2.8	15.3	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.9
EBAE72	80.0	3.2	0.3	15.1	2.8	15.4	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.9
ABAE73	77.2	2.9	0.3	13.9	2.8	14.0	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
BBAE73	78.0	2.9	0.3	13.9	2.8	14.7	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
CBAE73	78.2	3.0	0.3	13.9	2.8	14.8	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9

Table 14-1. Average annual recreation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Fort Peck Lake	Downstream of Fort Peck Dam	Lake Sakakawea	Downstream of Garrison Dam	Lake Oahe	Lake Sharpe	Lake Francis Case	Downstream of Fort Randall Dam	Lewis & Clark Lake	Downstream of Gavins Point Dam	Sioux City Reach	St. Joseph Reach	Kansas City Reach	Boonville Reach	Hermann Reach
DBAE73	79.3	3.1	0.3	14.5	2.8	15.3	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
EBAE73	79.6	3.2	0.3	14.7	2.8	15.4	7.1	9.5	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.9
ABAE81	76.7	2.8	0.3	13.6	2.8	13.8	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
BBAE81	77.6	2.9	0.3	14.0	2.8	14.2	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
CBAE81	78.7	3.0	0.3	14.3	2.8	14.9	7.1	9.7	0.8	9.1	4.2	9.6	0.5	0.8	0.6	0.9
DBAE81	79.8	3.1	0.3	14.7	2.8	15.5	7.1	9.7	0.8	9.1	4.2	9.5	0.5	0.8	0.6	0.9
EBAE81	81.0	3.2	0.3	15.6	2.8	16.0	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.8
ABAE82	76.0	2.8	0.3	13.3	2.8	13.7	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
BBAE82	77.9	3.0	0.3	13.8	2.8	14.8	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
CBAE82	79.0	3.1	0.3	14.4	2.8	15.2	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
DBAE82	79.2	3.1	0.3	14.4	2.8	15.4	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
EBAE82	80.6	3.2	0.3	15.5	2.7	16.0	7.1	9.7	0.8	9.1	4.1	9.2	0.5	0.8	0.6	0.8
ABAE83	75.9	2.7	0.3	13.0	2.8	13.9	7.1	9.7	0.8	9.1	4.2	9.4	0.5	0.8	0.6	0.9
BBAE83	76.4	2.9	0.3	13.7	2.8	13.6	7.1	9.7	0.8	9.1	4.1	9.4	0.5	0.8	0.6	0.9
CBAE83	78.6	3.0	0.3	14.2	2.8	15.1	7.1	9.7	0.8	9.1	4.1	9.3	0.5	0.8	0.6	0.9
DBAE83	78.9	3.1	0.3	14.3	2.8	15.3	7.1	9.7	0.8	9.1	4.1	9.3	0.5	0.8	0.6	0.9
EBAE83	80.6	3.3	0.3	15.6	2.7	16.0	7.1	9.7	0.8	9.1	4.0	9.1	0.5	0.8	0.6	0.8
ABAE91	78.2	2.9	0.3	14.3	2.8	14.1	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
BBAE91	78.7	2.9	0.3	14.3	2.8	14.7	7.1	9.5	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
CBAE91	79.2	3.0	0.3	14.4	2.8	15.0	7.1	9.6	0.9	9.1	4.4	9.9	0.5	0.8	0.6	0.9
DBAE91	80.1	3.1	0.3	14.8	2.8	15.4	7.1	9.6	0.9	9.1	4.4	9.8	0.5	0.8	0.6	0.9
EBAE91	80.6	3.2	0.3	15.2	2.8	15.5	7.1	9.6	0.9	9.1	4.3	9.8	0.5	0.8	0.6	0.9
ABAE92	77.8	2.9	0.3	14.2	2.8	14.2	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
BBAE92	78.2	3.0	0.3	13.8	2.8	14.9	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
CBAE92	78.7	3.0	0.3	14.2	2.8	15.0	7.1	9.6	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
DBAE92	79.6	3.1	0.3	14.6	2.8	15.4	7.1	9.6	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
EBAE92	80.1	3.2	0.3	15.0	2.8	15.5	7.1	9.6	0.8	9.1	4.3	9.6	0.5	0.8	0.6	0.9
ABAE93	77.2	2.9	0.3	13.8	2.8	14.0	7.1	9.5	0.9	9.1	4.3	9.7	0.5	0.8	0.6	0.9
BBAE93	77.9	2.9	0.3	13.8	2.8	14.7	7.1	9.6	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
CBAE93	78.4	3.0	0.3	13.9	2.8	15.0	7.1	9.6	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
DBAE93	79.4	3.1	0.3	14.5	2.8	15.4	7.1	9.5	0.9	9.1	4.3	9.6	0.5	0.8	0.6	0.9
EBAE93	79.9	3.2	0.3	14.9	2.8	15.6	7.1	9.5	0.8	9.1	4.2	9.5	0.5	0.8	0.6	0.9
EVQ2XX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

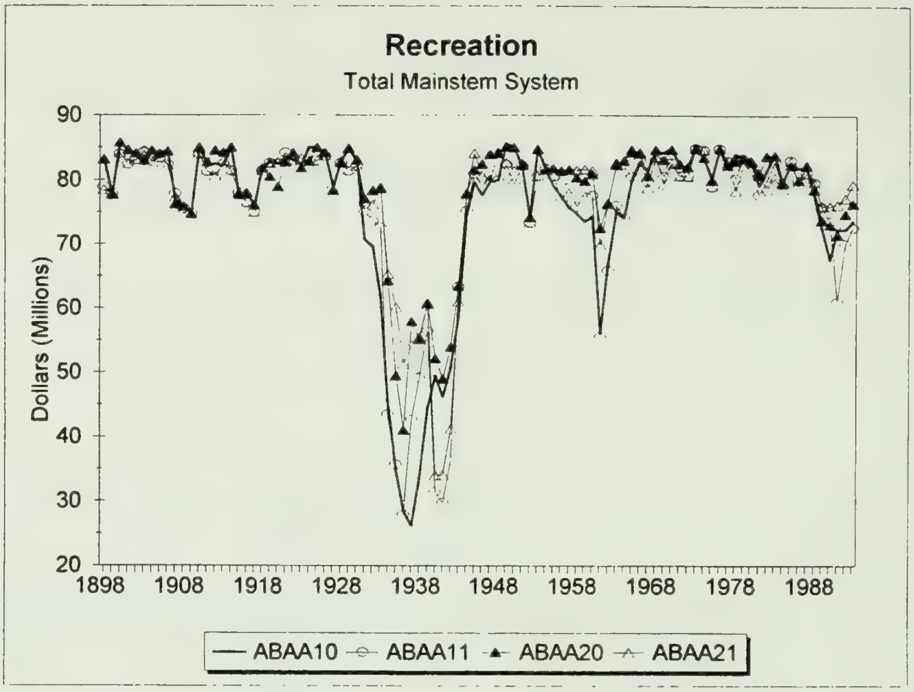

Figure 14-1. Annual recreation benefits of the total Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

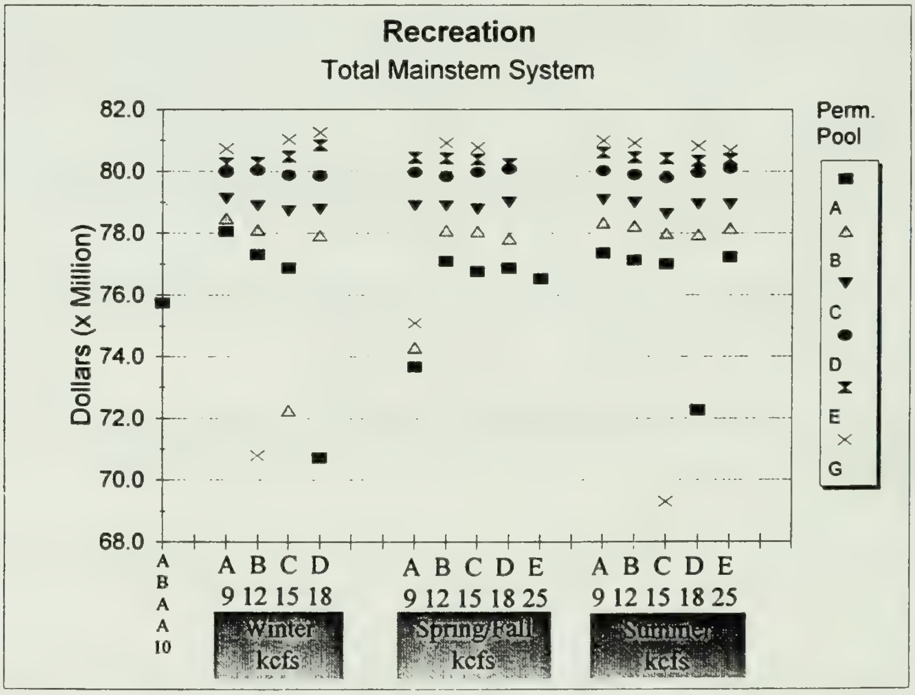

Figure 14-2. Average annual recreation benefits of the Mainstem System by nonnavigation service level.

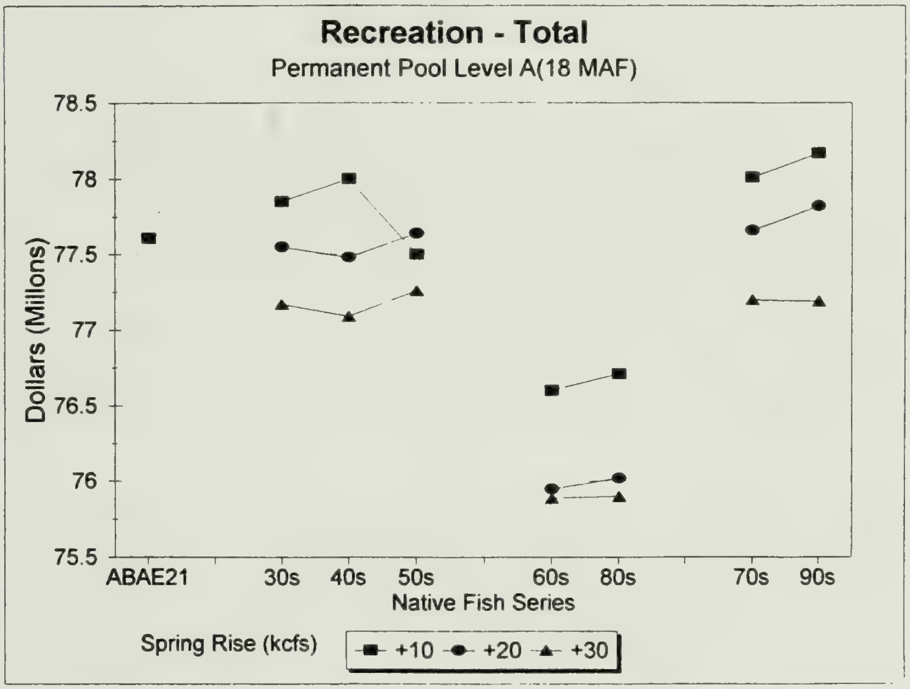

Figure 14-3. Average annual recreation benefits of the Mainstem System by Native Fish alternatives and degree of flood control.

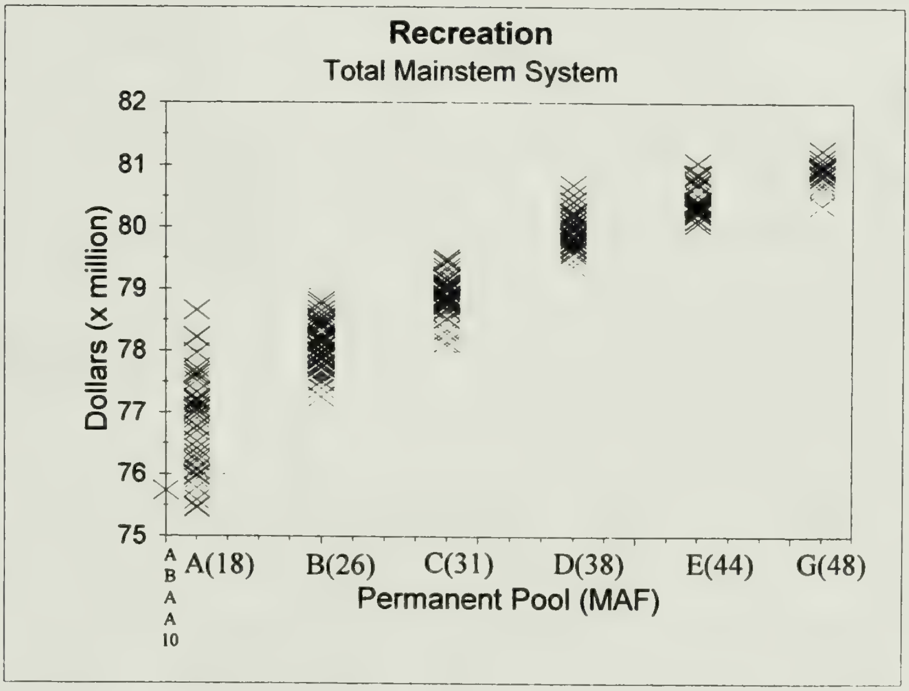

Figure 14-4. Average annual recreation benefits of the Mainstem System by permanent pool level.

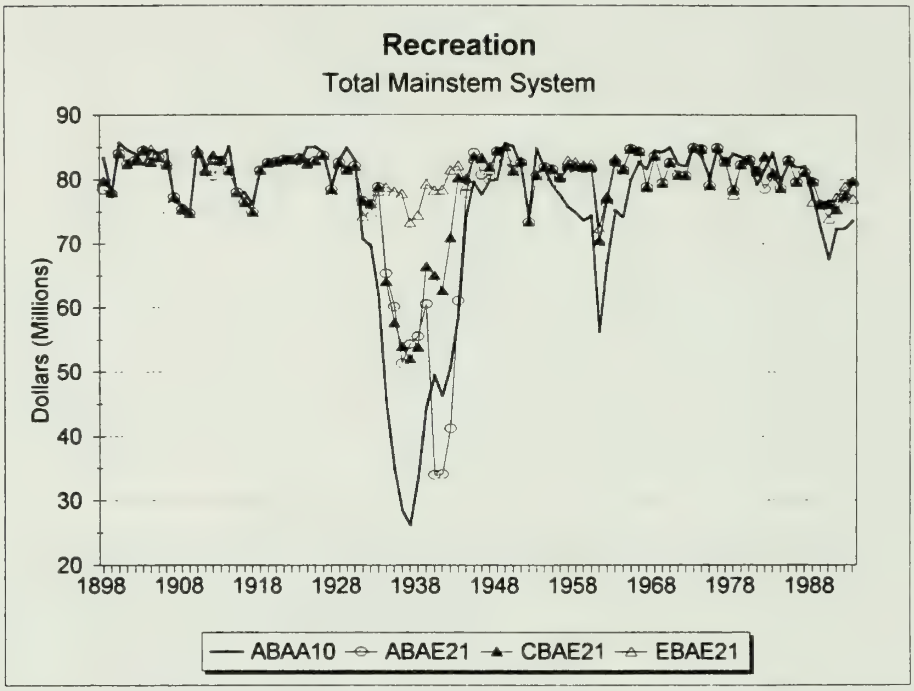

Figure 14-5. Annual recreation benefits of the total Mainstem System over the 96-year simulation period for alternatives ABAA10, ABAE21, CBAE21, and EBAE21.

15.0 NAVIGATION

The NED value of navigation is based primarily on a rate study that was undertaken to determine the full origin-to-destination cost of moving products by barge at drafts 1/2 foot above full service, full service, reduced service, minimum service, and drafts 1/2 foot below minimum service compared to movement by alternative modes, and for farm products, the price for barge shipment compared to the next best bid. When flows are reduced the tonnage per barge and the number of barges per tow are reduced, resulting in increased costs per ton and loss of economic value of Missouri River navigation. The RED value of navigation also includes cost savings to railroad transporters because a competitive mode of transport is available.

Changes in the way the Missouri River Mainstem System is operated affect the system's navigation use. Under the current Water Control Plan (alternative ABAA10), average annual navigation benefits equal $17.7 million. Current operations maximize the value of navigation on the river; none of the alternatives would increase the value of navigation (Table 15-1).

The estimated navigation system benefits of the other 382 alternatives range as low as $8.8 million (alternative EBAE83), a reduction of 50 percent. Thus, within the full range of alternatives that were studied, some would slightly reduce length of the navigation season in a few years and some would cause such great reductions that the long-term viability of the industry would be threatened.

The negative impacts on navigation would be distributed among the four reaches downstream of Gavins Point Dam proportionately with the value of shipping on each reach, with approximately 25 percent occurring in the Sioux City reach, 25 percent in the Omaha reach, 15 percent in the Nebraska City reach, and 35 percent in the Kansas City reach (Table 15-1). Barge transport in the Kansas City reach, for example, accounts for the greatest portion of total goods shipped and received on the Missouri River; therefore, this reach is most affected by any reduction or disruption of navigation service.

In summary:

- The modified navigation criteria would reduce the river's average annual navigation value, because it would increase the number of months in which there would be no navigation or reduce the level of navigation service.

- Modified intrasystem regulation would have no appreciable effect on navigation.

- Changes to minimum seasonal nonnavigation service levels affect later navigation seasons by affecting the amount of water for later release. The higher the nonnavigation season water releases, the less water is available later to support navigation and the lower the value of system navigation.

- Increases in spring service levels with the Native Fish Series would decrease the river's navigation value by releasing water in excess of navigation's needs in the spring and having inadequate water to meet navigation's needs in the summer and fall.

- Permanent pool criteria determine how low total system water storage is allowed to fall during droughts, and therefore the extent to which navigation can be supported. The higher the permanent pool level, the lower the system's navigation value.

15.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

The effect of the modified navigation criteria would be to decrease the river's navigation value by about 4.5 percent, from $17.7 million annually under alternative ABAA10 to $16.9 million under alternative ABAA20 (Table 15-1).

In most years, the modified navigation criteria would have little or no effect (Figure 15-1). During drought years, however, the effect of the modified criteria compared to the current Water Control Plan is to lower the discharge from Gavins Point Dam and provide fewer months of navigation service earlier in a drought. During the drought years of the 1930s, 1950s, and 1980s, the navigation season would be curtailed at the end of September instead of running through November, reducing the navigation season by 2 months. Under the current Water Control Plan, there would not be enough water in the system to have any navigation at all in 1937. Under the modified navigation criteria, the water saved in the system would provide support for a minimum navigation season in 1937. The gain in navigation service for that year would not be sufficient to offset the losses in the other drought years, however.

Modified intrasystem regulation would have very little effect on navigation. Alternatives ABAA10 and ABAA11 would have the same average annual navigation value: $17.7 million. When combined with the modified navigation criteria, modified intrasystem regulation would marginally decrease the system's navigation value, from $16.9 million under alternative ABAA20 to $16.8 million under alternative ABAA21 (Table 15-1).

15.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVEL

Higher minimum nonnavigation service levels are associated with lower navigation values (Figure 15-2). Water stored during one period is available for release at a later time. In the low range of minimum flows (e.g., A = 9 kcfs and B = 12 kcfs), more water is stored in the reservoirs and is available for later release, when it could benefit navigation. At higher minimum flows (e.g., D = 18 kcfs and E = 25 kcfs), more water is released down the river and less is stored, leaving less water available for later release that could benefit navigation. In the A-pool series, for example, alternative AAAA21 (winter, spring/fall, and summer flows = 9 kcfs) would have an average annual navigation value of $17.1 million, while alternative ADDE21 (winter and spring/summer flows = 18 kcfs and summer flow = 25 cfs) would drop the average annual navigation value to $14.7 million, a 14-percent loss in navigation value (Table 15-1).

15.3 EFFECT OF NATIVE FISH SERIES

All alternatives that provide higher spring flows for native fish reduce navigation benefits compared to following the current Water Control Plan. Figure 15-3 illustrates the effects when combined with permanent pool level A. Comparable changes occur at other permanent pool levels. Navigation benefits drop as the spring flow becomes progressively higher (Figure 15-3).

At these different flow levels, navigation benefits are also affected by the degree to which flood control constraints are kept in place to control downstream flooding. Where the prescribed spring flow of 45, 55, or 65 kcfs is reduced if flooding is threatened (30s on Figure 15-3), a reasonably high level of navigation benefits is retained because the water saved is available later when it can be of use to navigation. Those benefits drop slightly when a less aggressive flood control policy is followed (40s on Figure 15-3), and drop dramatically when there are no flood control constraints (50s on Figure 15-3). In the latter case, high spring releases to benefit native fish would go into effect even when it was known that the additional flow would exacerbate flooding downstream. That water would not be useful to navigation in the spring and would be unavailable later when it might be needed.

Navigation benefits are in the range of $15 million to $16.5 million annually, when the objective remains a full length navigation season (30s, 40s, and 50s on Figure 15-3). Navigation benefits drop to a range of $13 million to $14.5 million when the navigation season is shortened, eliminating navigation releases in October and November (70s and 90s on Figure 15-3). Split navigation seasons reduce average annual navigation values to the $11 million to $13 million range (60s and 80s on Figure 15-3).

15.4 PERMANENT POOL LEVEL

Over the 96-year simulation period, navigation benefits for the entire system fall during drought periods to a greater extent as pool elevations increase among the series of alternatives. This reduction in benefits occurs because of the adverse effects on navigation of not having enough water in the navigation season. During drought years, alternatives with higher permanent pool elevations have insufficient water available to support a full-service navigation season. This is particularly true of the E and G pool series (Figure 15-4).

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Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
ABAA10	17.68	4.29	4.00	2.60	6.79
ABAA11	17.66	4.28	4.00	2.60	6.78
ABAA20	16.87	4.11	3.85	2.47	6.44
AAAA21	17.11	4.15	3.89	2.52	6.54
AAAB21	17.11	4.15	3.89	2.52	6.54
AAAC21	17.11	4.15	3.89	2.52	6.54
AAAD21	17.11	4.15	3.89	2.52	6.54
AAAE21	17.11	4.15	3.89	2.52	6.54
AABB21	17.01	4.13	3.87	2.50	6.51
AABC21	17.01	4.13	3.87	2.50	6.51
AABD21	17.01	4.13	3.87	2.50	6.51
AABE21	17.01	4.13	3.87	2.50	6.51
AACC21	16.91	4.11	3.85	2.48	6.47
AACD21	16.91	4.11	3.85	2.48	6.47
AACE21	16.91	4.11	3.85	2.48	6.47
AADD21	16.62	4.03	3.77	2.46	6.37
AADE21	16.41	3.97	3.71	2.43	6.30
AAEE21	15.27	3.66	3.41	2.31	5.89
ABAA21	16.82	4.09	3.83	2.46	6.43
ABAB21	16.82	4.09	3.83	2.46	6.43
ABAC21	16.82	4.09	3.83	2.46	6.43
ABAD21	16.82	4.09	3.83	2.46	6.43
ABAE21	16.82	4.09	3.83	2.46	6.43
ABBB21	16.70	4.06	3.80	2.45	6.39
ABBC21	16.66	4.05	3.79	2.44	6.37
ABBD21	16.64	4.05	3.79	2.44	6.36
ABBE21	16.65	4.05	3.79	2.44	6.37
ABCC21	16.49	4.00	3.74	2.43	6.31
ABCD21	16.52	4.01	3.75	2.44	6.33
ABCE21	16.34	3.96	3.70	2.42	6.26
ABDD21	16.18	3.91	3.66	2.41	6.21
ABDE21	16.08	3.88	3.63	2.40	6.17
ACAA21	16.50	4.02	3.77	2.41	6.30
ACAB21	16.49	4.02	3.77	2.41	6.30
ACAC21	16.44	3.99	3.73	2.42	6.29
ACAD21	16.46	4.00	3.74	2.43	6.30
ACAE21	16.38	3.98	3.73	2.41	6.27
ACBB21	16.40	3.99	3.73	2.42	6.27

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
ACBC21	16.34	3.97	3.72	2.40	6.25
ACBD21	16.37	3.98	3.73	2.40	6.26
ACBE21	16.12	3.90	3.65	2.39	6.18
ACCC21	16.16	3.92	3.67	2.39	6.18
ACCD21	16.20	3.93	3.68	2.39	6.20
ACCE21	15.86	3.83	3.57	2.37	6.09
ACDD21	15.86	3.83	3.59	2.36	6.08
ACDE21	15.65	3.77	3.52	2.34	6.01
ADAA21	16.23	3.95	3.70	2.38	6.19
ADAB21	16.21	3.95	3.70	2.37	6.19
ADAC21	16.11	3.91	3.66	2.38	6.16
ADAD21	16.06	3.90	3.65	2.37	6.14
ADAE21	15.84	3.83	3.58	2.36	6.07
ADBB21	15.98	3.88	3.64	2.35	6.11
ADBC21	15.95	3.88	3.63	2.35	6.10
ADBD21	15.84	3.83	3.58	2.36	6.07
ADBE21	15.70	3.79	3.55	2.34	6.02
ADCC21	15.69	3.80	3.55	2.33	6.01
ADCD21	15.74	3.81	3.57	2.33	6.03
ADCE21	15.49	3.74	3.50	2.31	5.95
ADDD21	15.49	3.74	3.50	2.31	5.94
ADDE21	14.67	3.49	3.25	2.25	5.68
BAAA21	17.09	4.15	3.88	2.52	6.54
BAAB21	17.09	4.15	3.88	2.52	6.54
BAAC21	17.09	4.15	3.88	2.52	6.54
BAAD21	17.09	4.15	3.88	2.52	6.54
BAAE21	17.09	4.15	3.88	2.52	6.54
BABB21	16.97	4.11	3.85	2.51	6.50
BABC21	16.96	4.11	3.84	2.51	6.50
BABD21	16.96	4.11	3.84	2.51	6.50
BABE21	16.83	4.07	3.80	2.51	6.46
BACC21	16.82	4.06	3.80	2.50	6.45
BACD21	16.77	4.05	3.79	2.49	6.44
BACE21	16.60	4.00	3.74	2.48	6.38
BADD21	16.52	3.99	3.73	2.46	6.34
BADE21	16.09	3.87	3.61	2.42	6.20
BBAA21	16.84	4.08	3.82	2.48	6.44
BBAB21	16.78	4.06	3.79	2.49	6.44

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
BBAC21	16.75	4.05	3.79	2.49	6.43
BBAD21	16.75	4.05	3.79	2.49	6.42
BBAE21	16.70	4.04	3.78	2.48	6.40
BBBB21	16.67	4.03	3.78	2.47	6.39
BBBC21	16.70	4.04	3.78	2.47	6.40
BBBD21	16.66	4.04	3.78	2.46	6.39
BBBE21	16.19	3.90	3.64	2.43	6.23
BBCC21	16.30	3.93	3.68	2.43	6.26
BBCD21	16.32	3.94	3.68	2.44	6.26
BBCE21	16.01	3.85	3.60	2.41	6.16
BBDD21	15.98	3.84	3.59	2.40	6.15
BBDE21	15.73	3.77	3.52	2.38	6.06
BCAA21	16.57	4.02	3.77	2.45	6.34
BCAB21	16.55	4.01	3.76	2.44	6.33
BCAC21	16.52	4.01	3.75	2.44	6.32
BCAD21	16.37	3.96	3.71	2.43	6.27
BCAE21	16.06	3.87	3.62	2.40	6.16
BCBB21	16.47	3.99	3.74	2.44	6.30
BCBC21	16.22	3.92	3.66	2.42	6.22
BCBD21	16.21	3.92	3.66	2.42	6.21
BCBE21	15.91	3.83	3.58	2.39	6.11
BCCC21	15.93	3.83	3.58	2.39	6.12
BCCD21	15.89	3.83	3.57	2.38	6.10
BCCE21	15.22	3.63	3.38	2.32	5.88
BCDD21	15.70	3.78	3.53	2.36	6.04
BCDE21	15.06	3.58	3.33	2.31	5.83
BDAA21	16.33	3.96	3.70	2.42	6.25
BDAB21	15.99	3.87	3.62	2.38	6.13
BDAC21	16.08	3.89	3.64	2.39	6.16
BDAD21	15.85	3.82	3.56	2.38	6.09
BDAE21	15.65	3.77	3.52	2.35	6.02
BDBB21	15.91	3.84	3.59	2.37	6.10
BDBC21	15.78	3.80	3.55	2.36	6.06
BDBD21	15.64	3.76	3.51	2.35	6.01
BDBE21	15.29	3.66	3.41	2.32	5.90
BDCC21	15.55	3.74	3.50	2.33	5.97
BDCD21	15.54	3.74	3.50	2.33	5.97
BDCE21	14.76	3.49	3.24	2.29	5.74

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
BDDD21	15.24	3.65	3.41	2.31	5.87
CAAA21	17.09	4.13	3.87	2.54	6.55
CAAB21	17.12	4.14	3.87	2.55	6.56
CAAC21	17.11	4.14	3.87	2.55	6.56
CAAD21	17.10	4.13	3.87	2.55	6.56
CAAE21	16.93	4.09	3.82	2.53	6.50
CABB21	16.75	4.03	3.76	2.51	6.44
CABC21	16.71	4.02	3.76	2.51	6.42
CABD21	16.81	4.05	3.78	2.53	6.46
CABE21	16.63	4.00	3.73	2.51	6.40
CACC21	16.72	4.03	3.76	2.50	6.43
CACD21	16.58	3.98	3.72	2.50	6.38
CACE21	16.17	3.87	3.61	2.45	6.23
CADD21	16.39	3.93	3.67	2.48	6.31
CADE21	15.88	3.79	3.53	2.43	6.14
CBAA21	16.90	4.08	3.81	2.52	6.49
CBAB21	16.63	4.00	3.74	2.49	6.39
CBAC21	16.66	4.01	3.75	2.50	6.40
CBAD21	16.70	4.02	3.76	2.50	6.42
CBAE21	16.54	3.97	3.71	2.49	6.36
CBBB21	16.65	4.01	3.75	2.49	6.39
CBBC21	16.78	4.05	3.78	2.51	6.44
CBBD21	16.48	3.96	3.70	2.48	6.34
CBBE21	16.02	3.83	3.58	2.43	6.18
CBCC21	16.10	3.87	3.62	2.42	6.18
CBCD21	16.21	3.90	3.64	2.44	6.23
CBCE21	15.74	3.76	3.51	2.40	6.07
CBDD21	15.60	3.72	3.46	2.39	6.03
CBDE21	15.22	3.62	3.36	2.35	5.90
CCAA21	16.61	4.02	3.76	2.47	6.36
CCAB21	16.58	4.01	3.75	2.47	6.35
CCAC21	16.54	4.00	3.75	2.46	6.33
CCAD21	16.28	3.93	3.68	2.44	6.24
CCAE21	15.84	3.80	3.55	2.39	6.09
CCBB21	16.50	3.98	3.72	2.47	6.33
CCBC21	16.01	3.86	3.61	2.40	6.14
CCBD21	16.12	3.88	3.63	2.42	6.19
CCBE21	15.54	3.71	3.45	2.37	6.00

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
CCCC21	15.79	3.79	3.54	2.39	6.08
CCCD21	15.76	3.77	3.51	2.40	6.08
CCCE21	15.15	3.60	3.34	2.33	5.87
CCDD21	15.36	3.66	3.40	2.36	5.94
CDAA21	16.36	3.95	3.70	2.44	6.27
CDAB21	16.32	3.94	3.69	2.43	6.26
CDAC21	16.00	3.86	3.60	2.40	6.14
CDAD21	15.75	3.78	3.53	2.38	6.07
CDAE21	15.42	3.68	3.43	2.35	5.96
CDBB21	15.77	3.79	3.54	2.37	6.06
CDBC21	15.69	3.77	3.52	2.37	6.04
CDBD21	15.45	3.70	3.45	2.35	5.96
CDBE21	15.05	3.58	3.32	2.32	5.84
CDCC21	15.49	3.71	3.47	2.34	5.97
CDCD21	15.07	3.58	3.32	2.33	5.85
CDDD21	14.91	3.53	3.28	2.31	5.79
DAAA21	17.03	4.10	3.83	2.55	6.54
DAAB21	16.99	4.09	3.83	2.54	6.52
DAAC21	16.79	4.03	3.77	2.53	6.46
DAAD21	17.01	4.09	3.82	2.56	6.54
DAAE21	16.87	4.05	3.78	2.54	6.49
DABB21	16.95	4.08	3.81	2.55	6.51
DABC21	16.92	4.07	3.81	2.54	6.50
DABD21	16.44	3.95	3.69	2.47	6.33
DABE21	16.05	3.83	3.56	2.45	6.20
DACC21	16.21	3.88	3.62	2.46	6.25
DACD21	16.21	3.88	3.62	2.46	6.25
DACE21	15.66	3.72	3.46	2.41	6.07
DADD21	15.84	3.78	3.52	2.42	6.12
DBAA21	16.26	3.90	3.64	2.46	6.27
DBAB21	16.26	3.90	3.64	2.46	6.27
DBAC21	16.30	3.90	3.65	2.47	6.28
DBAD21	16.19	3.87	3.61	2.46	6.25
DBAE21	15.95	3.80	3.55	2.43	6.17
DBBB21	16.26	3.90	3.64	2.46	6.26
DBBC21	16.14	3.86	3.61	2.45	6.22
DBBD21	15.99	3.82	3.57	2.43	6.16
DBBE21	15.53	3.68	3.42	2.40	6.02

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
DBCC21	15.91	3.81	3.55	2.42	6.13
DBCD21	15.70	3.74	3.48	2.41	6.07
DBDD21	15.32	3.63	3.37	2.37	5.94
DCAA21	16.15	3.88	3.62	2.44	6.21
DCAB21	16.15	3.88	3.62	2.44	6.21
DCAC21	16.03	3.84	3.59	2.43	6.17
DCAD21	15.89	3.80	3.55	2.41	6.12
DCAE21	15.41	3.66	3.40	2.38	5.97
DCBB21	16.02	3.83	3.58	2.44	6.17
DCBC21	15.74	3.76	3.51	2.40	6.07
DCBD21	15.90	3.80	3.54	2.42	6.14
DCBE21	14.30	3.32	3.06	2.30	5.62
DCCC21	15.54	3.70	3.45	2.38	6.01
DCCD21	15.13	3.57	3.31	2.36	5.89
DCDD21	14.45	3.37	3.11	2.31	5.66
DDAA21	15.81	3.79	3.54	2.39	6.09
DDAB21	15.39	3.66	3.41	2.36	5.95
DDAC21	15.43	3.69	3.44	2.35	5.95
DDAD21	15.33	3.66	3.41	2.34	5.92
DDAE21	14.20	3.30	3.05	2.27	5.57
DDBB21	15.41	3.69	3.44	2.34	5.95
DDBC21	15.31	3.65	3.41	2.34	5.92
DDBD21	15.12	3.58	3.33	2.33	5.87
DDCC21	14.93	3.54	3.29	2.31	5.80
DDCD21	14.40	3.36	3.10	2.30	5.65
EAAA21	15.90	3.78	3.53	2.44	6.14
EAAB21	15.88	3.78	3.53	2.44	6.13
EAAC21	15.99	3.81	3.56	2.44	6.17
EAAD21	15.93	3.79	3.54	2.44	6.16
EAAE21	15.92	3.79	3.53	2.44	6.15
EABB21	15.74	3.74	3.49	2.42	6.09
EABC21	15.89	3.79	3.53	2.43	6.14
EABD21	15.68	3.72	3.47	2.42	6.07
EABE21	15.78	3.75	3.49	2.43	6.11
EACC21	15.76	3.76	3.51	2.41	6.08
EACD21	16.00	3.80	3.55	2.46	6.18
EADD21	15.46	3.67	3.42	2.39	5.98
EBAA21	15.76	3.76	3.51	2.42	6.08

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
EBAB21	15.64	3.72	3.47	2.40	6.04
EBAC21	15.43	3.66	3.41	2.39	5.97
EBAD21	15.77	3.76	3.51	2.41	6.08
EBAE21	15.57	3.70	3.45	2.40	6.03
EBBB21	15.40	3.65	3.41	2.38	5.96
EBBC21	15.57	3.70	3.45	2.40	6.02
EBBD21	15.46	3.68	3.43	2.38	5.98
EBCC21	15.27	3.62	3.37	2.37	5.91
EBCD21	15.22	3.61	3.36	2.35	5.89
ECAA21	15.57	3.71	3.47	2.39	6.00
ECAB21	15.45	3.68	3.43	2.37	5.97
ECAC21	15.36	3.64	3.40	2.37	5.94
ECAD21	15.24	3.61	3.37	2.36	5.90
ECBB21	15.45	3.67	3.43	2.38	5.97
ECBC21	15.22	3.61	3.36	2.36	5.89
ECBD21	15.07	3.57	3.32	2.34	5.84
ECCC21	14.64	3.43	3.18	2.32	5.71
ECCD21	14.57	3.40	3.16	2.32	5.69
EDAA21	15.23	3.61	3.36	2.36	5.90
EDAB21	14.71	3.46	3.21	2.31	5.72
EDAC21	14.68	3.45	3.20	2.32	5.72
EDBB21	14.66	3.44	3.20	2.31	5.71
EDBC21	14.49	3.40	3.15	2.29	5.65
EDBD21	14.48	3.39	3.14	2.30	5.66
EDCC21	28.98	6.78	6.28	4.60	11.32
GAAA21	16.15	3.82	3.57	2.52	6.24
GAAB21	15.48	3.66	3.42	2.42	5.98
GAAC21	15.38	3.63	3.39	2.41	5.95
GAAD21	15.46	3.65	3.41	2.42	5.98
GAAE21	15.14	3.55	3.31	2.39	5.88
GABB21	14.95	3.52	3.28	2.35	5.80
GABC21	14.88	3.50	3.26	2.34	5.77
GABD21	14.90	3.51	3.27	2.34	5.78
GACC21	14.88	3.50	3.26	2.34	5.77
GACD21	14.79	3.47	3.23	2.34	5.75
GBAA21	15.08	3.55	3.32	2.37	5.85
GBAB21	15.08	3.55	3.32	2.37	5.85
GBAC21	15.04	3.54	3.30	2.36	5.83

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
GBAD21	15.05	3.54	3.31	2.37	5.84
GBBB21	14.74	3.46	3.23	2.32	5.72
GBBC21	15.03	3.54	3.30	2.36	5.83
GBBD21	14.90	3.50	3.26	2.35	5.79
GBCC21	14.42	3.38	3.14	2.29	5.61
GCAA21	15.02	3.54	3.31	2.35	5.82
GCAB21	14.52	3.41	3.18	2.29	5.64
GCAC21	14.38	3.37	3.14	2.27	5.59
GCAD21	14.38	3.37	3.14	2.28	5.59
GCBB21	14.27	3.36	3.13	2.25	5.54
GDAA21	14.33	3.38	3.15	2.25	5.55
ABAE31	16.37	3.98	3.70	2.42	6.27
BBAE31	16.21	3.92	3.64	2.43	6.23
CBAE31	15.96	3.84	3.56	2.42	6.15
DBAE31	15.47	3.69	3.41	2.38	5.98
EBAE31	15.22	3.60	3.33	2.38	5.91
ABAE32	15.88	3.89	3.60	2.32	6.07
BBAE32	15.56	3.78	3.49	2.32	5.97
CBAE32	15.46	3.74	3.46	2.32	5.94
DBAE32	14.93	3.58	3.31	2.27	5.77
EBAE32	14.15	3.35	3.09	2.21	5.50
ABAE33	15.27	3.77	3.50	2.19	5.82
BBAE33	14.91	3.65	3.38	2.17	5.71
CBAE33	14.50	3.53	3.26	2.14	5.56
DBAE33	14.13	3.41	3.14	2.13	5.45
EBAE33	13.10	3.09	2.84	2.06	5.11
ABAE41	16.13	3.94	3.66	2.37	6.17
BBAE41	15.86	3.83	3.55	2.37	6.10
CBAE41	15.76	3.80	3.52	2.38	6.07
DBAE41	15.25	3.65	3.37	2.33	5.91
EBAE41	14.92	3.54	3.27	2.31	5.79
ABAE42	15.57	3.83	3.55	2.24	5.94
BBAE42	15.15	3.71	3.43	2.22	5.80
CBAE42	15.10	3.67	3.40	2.23	5.80
DBAE42	14.44	3.47	3.19	2.19	5.58
EBAE42	13.93	3.32	3.06	2.14	5.40
ABAE43	14.93	3.71	3.44	2.10	5.67
BBAE43	14.57	3.60	3.33	2.09	5.55

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
CBAE43	14.38	3.52	3.26	2.10	5.50
DBAE43	13.91	3.38	3.12	2.07	5.34
EBAE43	12.92	3.08	2.83	1.99	5.02
ABAE51	14.88	3.73	3.43	2.04	5.68
BBAE51	14.59	3.62	3.32	2.05	5.60
CBAE51	14.46	3.58	3.28	2.04	5.56
DBAE51	13.91	3.42	3.13	1.99	5.37
EBAE51	13.35	3.27	2.99	1.92	5.17
ABAE52	14.33	3.59	3.30	1.97	5.47
BBAE52	14.14	3.54	3.25	1.96	5.40
CBAE52	13.77	3.41	3.13	1.94	5.29
DBAE52	13.17	3.23	2.95	1.90	5.09
EBAE52	12.82	3.16	2.90	1.83	4.92
ABAE53	13.85	3.50	3.23	1.87	5.25
BBAE53	13.65	3.44	3.17	1.86	5.18
CBAE53	13.37	3.33	3.06	1.87	5.10
DBAE53	13.05	3.23	2.96	1.86	5.00
EBAE53	12.31	3.06	2.81	1.73	4.70
ABAE61	13.00	3.16	3.00	1.92	4.91
BBAE61	12.95	3.14	2.98	1.93	4.90
CBAE61	12.85	3.11	2.94	1.93	4.87
DBAE61	12.51	3.00	2.83	1.91	4.77
EBAE61	12.23	2.90	2.73	1.90	4.69
ABAE62	12.21	3.01	2.87	1.78	4.56
BBAE62	12.10	2.96	2.83	1.77	4.53
CBAE62	12.02	2.93	2.79	1.78	4.52
DBAE62	11.78	2.85	2.70	1.78	4.45
EBAE62	11.18	2.63	2.48	1.77	4.30
ABAE63	11.71	2.92	2.80	1.66	4.32
BBAE63	11.47	2.83	2.71	1.66	4.27
CBAE63	11.48	2.84	2.71	1.66	4.27
DBAE63	11.24	2.75	2.63	1.65	4.21
EBAE63	10.57	2.51	2.37	1.65	4.04
ABAE71	14.31	3.49	3.31	2.14	5.38
BBAE71	14.60	3.52	3.31	2.21	5.55
CBAE71	14.38	3.44	3.24	2.21	5.49
DBAE71	13.92	3.31	3.10	2.17	5.34
EBAE71	13.58	3.20	2.98	2.16	5.24

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
ABAE72	13.98	3.42	3.23	2.05	5.27
BBAE72	13.89	3.38	3.18	2.06	5.26
CBAE72	13.62	3.29	3.10	2.05	5.18
DBAE72	13.16	3.14	2.94	2.03	5.04
EBAE72	12.90	3.05	2.85	2.02	4.97
ABAE73	13.32	3.29	3.12	1.92	4.99
BBAE73	13.06	3.19	3.01	1.92	4.93
CBAE73	12.94	3.16	2.98	1.91	4.89
DBAE73	12.46	3.00	2.81	1.90	4.75
EBAE73	12.44	2.99	2.79	1.90	4.76
ABAE81	12.60	3.08	2.94	1.85	4.73
BBAE81	12.52	3.05	2.90	1.85	4.71
CBAE81	12.43	3.02	2.87	1.85	4.69
DBAE81	12.00	2.88	2.72	1.84	4.57
EBAE81	11.58	2.70	2.52	1.88	4.49
ABAE82	11.94	2.95	2.82	1.72	4.44
BBAE82	11.84	2.92	2.79	1.72	4.42
CBAE82	11.78	2.88	2.75	1.73	4.42
DBAE82	11.60	2.82	2.69	1.73	4.37
EBAE82	9.75	2.25	2.11	1.59	3.79
ABAE83	11.43	2.87	2.75	1.60	4.21
BBAE83	11.20	2.79	2.68	1.59	4.14
CBAE83	11.22	2.79	2.67	1.60	4.16
DBAE83	10.90	2.67	2.55	1.60	4.08
EBAE83	8.79	2.03	1.89	1.44	3.43
ABAE91	14.26	3.47	3.28	2.12	5.40
BBAE91	14.25	3.45	3.24	2.15	5.42
CBAE91	13.99	3.36	3.16	2.13	5.33
DBAE91	13.44	3.20	2.99	2.09	5.16
EBAE91	13.16	3.10	2.89	2.09	5.09
ABAE92	13.75	3.37	3.18	2.01	5.18
BBAE92	13.52	3.30	3.11	2.00	5.11
CBAE92	13.29	3.23	3.04	1.99	5.04
DBAE92	12.78	3.07	2.87	1.96	4.88
EBAE92	12.55	2.98	2.78	1.96	4.83
ABAE93	14.26	3.47	3.28	2.12	5.40
BBAE93	12.77	3.14	2.96	1.87	4.81
CBAE93	12.51	3.05	2.87	1.86	4.73

Table 15-1. Average annual navigation value over the 96-year simulation period (in millions of dollars).

Alternative	Total	Sioux City Reach	Omaha Reach	Nebraska City Reach	Kansas City Reach
DBAE93	12.20	2.94	2.76	1.85	4.65
EBAE93	11.66	2.75	2.55	1.85	4.52
Evq2XX	0.00	0.00	0.00	0.00	0.00

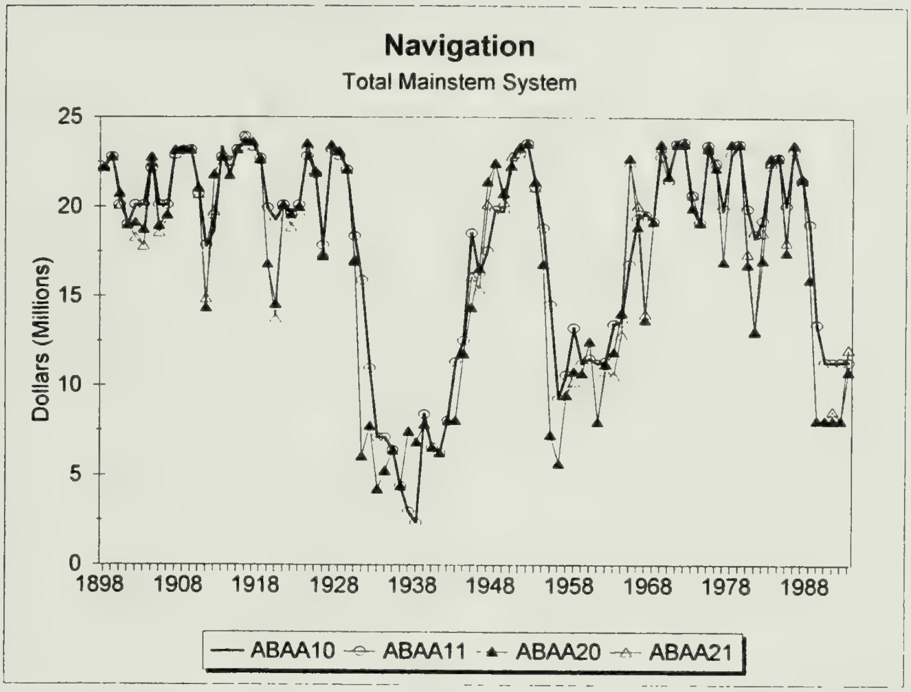

Figure 15-1. Annual navigation benefits of the total Mainstem System over the 96-year simulation period.

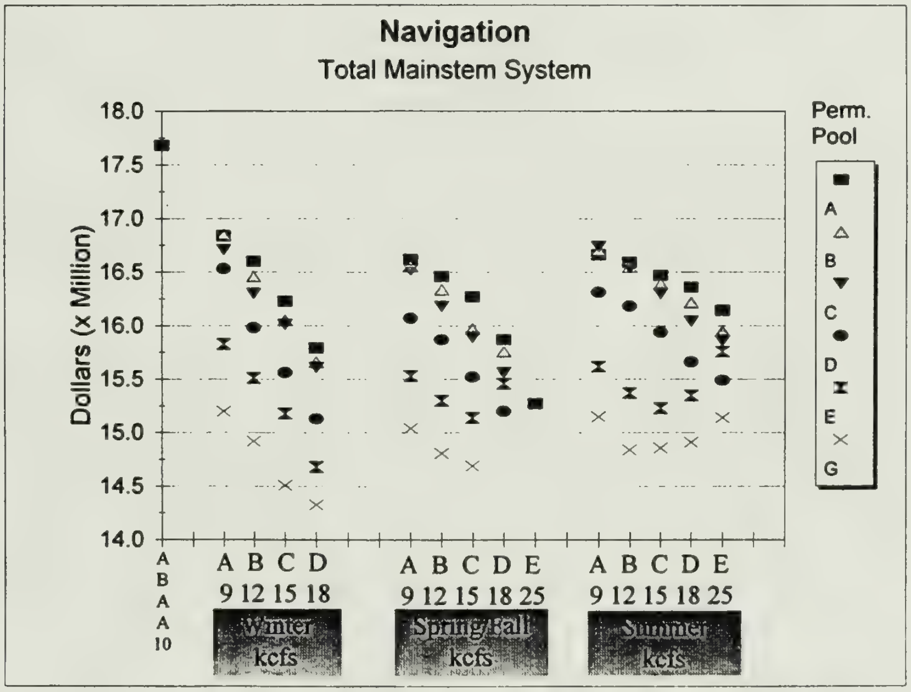

Figure 15-2. Average annual navigation benefits of the Mainstem System by nonnavigation service level.

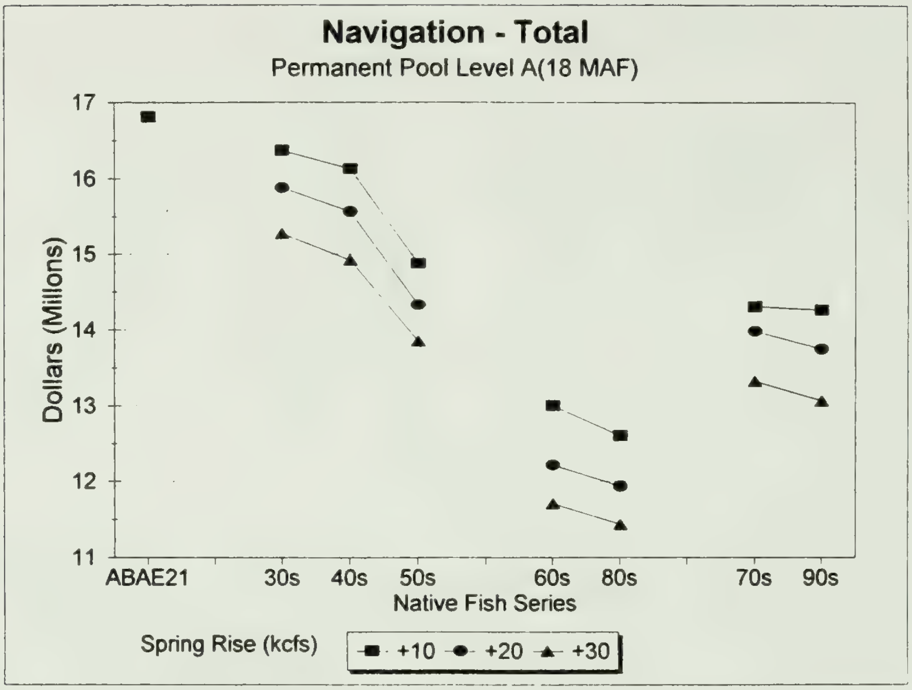

Figure 15-3. Average annual navigation benefits of the Mainstem System by native fish flow level and degree of flood control constraint.

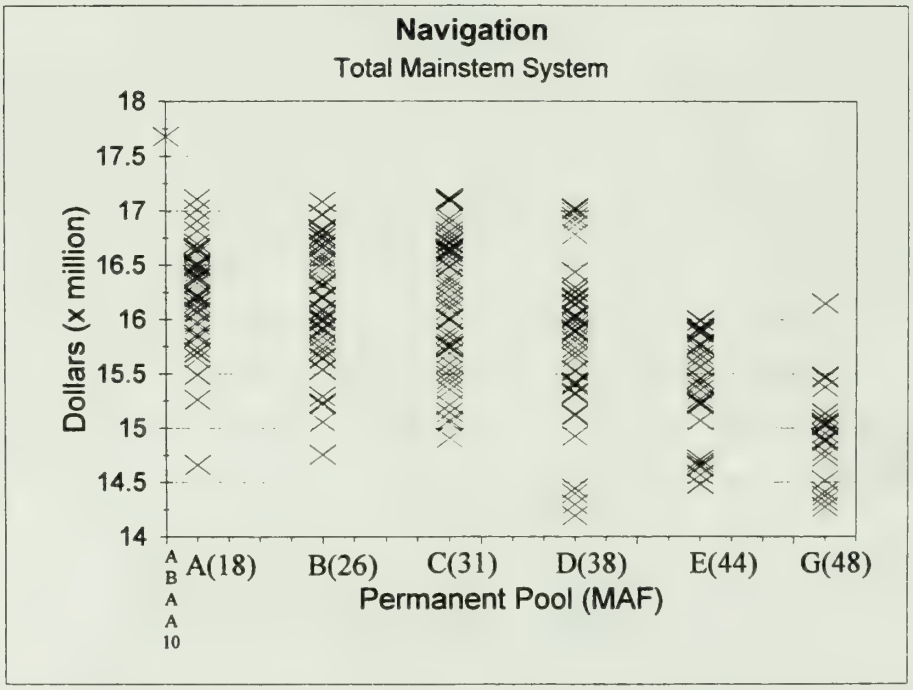

Figure 15-4. Average annual navigation benefits of the Mainstem System by permanent pool level.

16.0 HISTORIC PROPERTIES

An index of value was used to evaluate the effect of changes in Mainstem System operations on historic properties. Value is measured in terms of exposure of historic properties to wave action. The greater the exposure lessens the value of the property. Exposure to wave action is measured as a function of changing lake levels in the upper three mainstem lakes. A total of 2,795 historic properties that have been catalogued along these lakes are subject to erosion depending on their relationship over the period of study to the water surface elevation. Of these, 1,600 are located above maximum pool levels and would not be affected by project operations. The remainder are located at elevations within the range of active water level fluctuations, and are potentially subject to flooding and wave action. The index of value is the inverse of the number of times sites are exposed to wave action; therefore, the higher the index the less the number site exposures to wave action.

16.1 EFFECT OF MODIFIED NAVIGATION AND INTRASYSTEM REGULATION CRITERIA

The modified navigation criteria would reduce the value of historic properties located within or adjacent to the upper three mainstem lakes. The higher lake levels under the modified navigation criteria would increase site exposure to wave action. Over the 96-year simulation period, the value index is about 8 percent less under the modified navigation criteria (Table 16-1). The lower index occurs in the drought periods of the 1930s, late 1950s, and late 1980s (Figures 16-1 through 16-4), because of higher lake levels in droughts under the modified navigation criteria.

Modified intrasystem regulation has only a slight positive effect on the historic properties index (Table 16-1). The index is slightly higher sporadically over the 96-year simulation period (Figures 16-1 through 16-4), because lake levels vary slightly more for alternatives with modified intrasystem regulation.

Table 16-1. Average annual index of historic properties value for the three upper mainstem lakes over the 96-year simulation period.

Service Level	Intrasystem Regulation	Alternative	Total Index	Fort Peck Lake	Lake Sakakawea	Lake Oahe
Current	Current	ABAA10	4689	128	2479	2082
Modified	Current	ABAA20	4319	119	2284	1916
Current	Modified	ABAA11	4711	129	2501	2080
Modified	Modified	ABAA21	4369	121	2320	1928

16.2 EFFECT OF MINIMUM NONNAVIGATION SERVICE LEVELS

The historic properties value index improves slightly with increasing minimum nonnavigation service levels for the lower permanent pool levels (Figures 16-5 through 16-8). Higher service levels at lower permanent pools reduce lake elevations more in drought periods, thus reducing the number of sites exposed to wave action.

16.3 EFFECT OF NATIVE FISH SERIES

The historic properties index value improves with higher spring service levels under the Native Fish alternatives (Figures 16-9 through 16-13). The higher are the spring releases the lower are the lake levels and the less site exposure to wave action. Reduced flood control constraints on these releases also improves the index because lake level reductions are even greater.

16.4 EFFECT OF PERMANENT POOL LEVEL

The historic properties value index declines at higher permanent pools (Figure 16-14). Higher permanent pools maintain exposure of sites to wave action throughout the 96-year simulation period; whereas, under lower permanent pools exposure declines during drought periods as water levels and wave action declines.

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ABAA10	4689	128	2479	2082
ABAA11	4711	129	2501	2080
ABAA20	4319	119	2284	1916
AAAA21	4317	119	2286	1911
AAAB21	4317	119	2286	1911
AAAC21	4317	119	2286	1911
AAAD21	4317	119	2286	1911
AAAE21	4317	119	2286	1911
AABB21	4342	121	2302	1919
AABC21	4342	121	2302	1919
AABD21	4342	121	2302	1919
AABE21	4342	121	2302	1919
AACC21	4363	121	2315	1927
AACD21	4363	121	2315	1927
AACE21	4363	121	2315	1927
AADD21	4373	121	2321	1931
AADE21	4377	122	2323	1932
AAEE21	4453	123	2363	1968
ABAA21	4369	121	2320	1928
ABAB21	4369	121	2320	1928
ABAC21	4369	121	2320	1928
ABAD21	4369	121	2320	1928
ABAE21	4369	121	2320	1928
ABBB21	4378	121	2325	1932
ABBC21	4382	121	2328	1932
ABBD21	4385	121	2330	1933
ABBE21	4387	122	2330	1935
ABCC21	4389	121	2328	1939
ABCD21	4389	121	2327	1940
ABCE21	4394	122	2331	1942
ABDD21	4410	122	2339	1949
ABDE21	4422	122	2347	1952
ACAA21	4417	122	2348	1947
ACAB21	4420	122	2350	1948
ACAC21	4403	122	2338	1944
ACAD21	4405	122	2340	1943
ACAE21	4417	122	2348	1946
ACBB21	4422	122	2345	1954

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ACBC21	4430	122	2352	1955
ACBD21	4435	123	2355	1958
ACBE21	4421	122	2345	1954
ACCC21	4454	123	2363	1968
ACCD21	4459	123	2366	1969
ACCE21	4450	123	2361	1966
ACDD21	4483	123	2375	1984
ACDE21	4499	124	2386	1989
ADAA21	4473	124	2375	1974
ADAB21	4477	124	2377	1975
ADAC21	4459	123	2366	1970
ADAD21	4465	124	2369	1972
ADAE21	4459	123	2366	1970
ADBB21	4494	124	2385	1985
ADBC21	4501	124	2389	1988
ADBD21	4475	123	2370	1981
ADBE21	4489	124	2380	1985
ADCC21	4512	124	2391	1998
ADCD21	4524	124	2399	2000
ADCE21	4538	125	2408	2006
ADDD21	4548	125	2405	2019
ADDE21	4563	125	2418	2021
BAAA21	4309	119	2281	1909
BAAB21	4309	119	2281	1909
BAAC21	4309	119	2281	1909
BAAD21	4309	119	2281	1909
BAAE21	4309	119	2281	1909
BABB21	4313	119	2283	1911
BABC21	4316	119	2285	1912
BABD21	4319	119	2287	1913
BABE21	4312	119	2282	1910
BACC21	4321	119	2286	1916
BACD21	4327	119	2290	1918
BACE21	4331	119	2292	1919
BADD21	4352	120	2304	1928
BADE21	4345	120	2300	1926
BBAA21	4342	119	2301	1922
BBAB21	4316	119	2288	1909

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
BBAC21	4323	119	2292	1912
BBAD21	4330	119	2295	1915
BBAE21	4343	120	2301	1922
BBBB21	4344	120	2299	1926
BBBC21	4353	120	2304	1929
BBBD21	4362	120	2311	1931
BBBE21	4333	119	2295	1919
BBCC21	4350	120	2303	1927
BBCD21	4363	120	2309	1934
BBCE21	4362	120	2308	1933
BBDD21	4373	120	2316	1937
BBDE21	4395	121	2329	1945
BCAA21	4379	120	2319	1939
BCAB21	4386	121	2325	1941
BCAC21	4391	121	2329	1942
BCAD21	4371	120	2313	1938
BCAE21	4365	120	2312	1932
BCBB21	4396	121	2328	1947
BCBC21	4382	120	2319	1942
BCBD21	4391	120	2322	1948
BCBE21	4390	121	2323	1946
BCCC21	4382	120	2318	1944
BCCD21	4400	120	2329	1951
BCCE21	4389	120	2319	1951
BCDD21	4447	122	2351	1975
BCDE21	4436	121	2357	1958
BDAA21	4423	121	2344	1958
BDAB21	4422	122	2341	1959
BDAC21	4432	122	2346	1964
BDAD21	4399	120	2329	1949
BDAE21	4427	122	2343	1963
BDBB21	4439	122	2350	1967
BDBC21	4424	121	2342	1961
BDBD21	4429	121	2343	1964
BDBE21	4435	121	2345	1968
BDCC21	4469	122	2364	1983
BDCD21	4489	123	2374	1992
BDCE21	4451	122	2364	1965

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
BDDD21	4524	123	2385	2016
CAAA21	4266	118	2263	1886
CAAB21	4275	118	2263	1895
CAAC21	4281	118	2264	1899
CAAD21	4284	118	2265	1901
CAAE21	4278	118	2262	1899
CABB21	4254	117	2256	1881
CABC21	4268	117	2260	1891
CABD21	4276	117	2264	1895
CABE21	4284	118	2266	1900
CACC21	4301	118	2275	1908
CACD21	4290	118	2271	1902
CACE21	4300	118	2275	1907
CADD21	4319	118	2285	1915
CADE21	4307	118	2279	1910
CBAA21	4305	118	2280	1906
CBAB21	4283	118	2267	1898
CBAC21	4294	118	2272	1904
CBAD21	4301	118	2276	1907
CBAE21	4310	118	2280	1911
CBBB21	4317	118	2282	1917
CBBC21	4325	119	2289	1918
CBBD21	4316	118	2282	1916
CBBE21	4309	118	2280	1912
CBCC21	4323	118	2290	1915
CBCD21	4339	119	2295	1926
CBCE21	4320	118	2287	1915
CBDD21	4301	118	2283	1900
CBDE21	4335	119	2292	1924
CCAA21	4322	119	2298	1905
CCAB21	4342	119	2302	1921
CCAC21	4358	120	2304	1934
CCAD21	4348	119	2300	1929
CCAE21	4335	118	2292	1924
CCBB21	4345	119	2308	1918
CCBC21	4354	119	2305	1930
CCBD21	4371	119	2309	1942
CCBE21	4342	118	2297	1927

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
CCCC21	4358	119	2305	1934
CCCD21	4331	119	2299	1914
CCCE21	4357	119	2309	1930
CCDD21	4364	119	2313	1931
CDAA21	4365	120	2323	1922
CDAB21	4388	121	2327	1940
CDAC21	4390	120	2322	1947
CDAD21	4363	119	2308	1936
CDAE21	4370	120	2312	1937
CDBB21	4392	120	2330	1942
CDBC21	4396	120	2325	1951
CDBD21	4376	120	2318	1938
CDBE21	4382	120	2321	1941
CDCC21	4444	120	2347	1976
CDCD21	4374	120	2319	1935
CDDD21	4429	121	2352	1956
DAAA21	4185	117	2239	1829
DAAB21	4204	117	2241	1847
DAAC21	4195	117	2232	1846
DAAD21	4180	117	2240	1824
DAAE21	4222	117	2242	1863
DABB21	4190	117	2246	1827
DABC21	4212	117	2253	1842
DABD21	4185	116	2225	1843
DABE21	4199	117	2234	1849
DACC21	4153	117	2229	1807
DACD21	4150	117	2226	1807
DACE21	4174	117	2232	1824
DADD21	4169	117	2231	1820
DBAA21	4127	117	2207	1803
DBAB21	4145	117	2222	1806
DBAC21	4153	117	2229	1807
DBAD21	4154	117	2228	1809
DBAE21	4218	117	2241	1860
DBBB21	4173	117	2237	1819
DBBC21	4167	117	2233	1816
DBBD21	4197	117	2238	1841
DBBE21	4170	117	2234	1819

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
DBCC21	4237	118	2255	1864
DBCD21	4163	117	2227	1818
DBDD21	4185	117	2251	1816
DCAA21	4180	118	2245	1818
DCAB21	4208	118	2256	1834
DCAC21	4201	118	2251	1833
DCAD21	4234	118	2257	1860
DCAE21	4180	117	2239	1824
DCBB21	4213	118	2262	1833
DCBC21	4238	118	2262	1859
DCBD21	4279	118	2276	1886
DCBE21	4125	114	2193	1818
DCCC21	4211	118	2255	1838
DCCD21	4181	118	2246	1817
DCDD21	4101	114	2189	1798
DDAA21	4216	119	2266	1830
DDAB21	4141	118	2218	1805
DDAC21	4202	118	2255	1829
DDAD21	4233	118	2264	1851
DDAE21	4138	115	2205	1819
DDBB21	4281	119	2280	1882
DDBC21	4258	119	2277	1862
DDBD21	4197	118	2263	1815
DDCC21	4214	119	2273	1822
DDCD21	4091	114	2189	1788
EAAA21	3959	114	2085	1760
EAAB21	3972	114	2102	1756
EAAC21	3994	114	2123	1756
EAAD21	4005	114	2132	1759
EAAE21	4070	115	2169	1786
EABB21	3994	114	2122	1758
EABC21	4017	114	2140	1763
EABD21	4015	114	2140	1760
EABE21	4056	115	2166	1775
EACC21	4055	115	2168	1772
EACD21	4070	115	2172	1783
EADD21	4087	116	2194	1777
EBAA21	3991	115	2113	1764

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
EBAB21	4005	114	2130	1761
EBAC21	3969	113	2104	1752
EBAD21	4043	115	2157	1770
EBAE21	4059	115	2169	1775
EBBB21	3981	113	2113	1755
EBBC21	4012	114	2137	1762
EBBD21	4066	115	2168	1783
EBCC21	4030	114	2152	1764
EBCD21	4074	115	2183	1776
ECAA21	3982	114	2112	1757
ECAB21	3995	114	2121	1760
ECAC21	4022	114	2142	1766
ECAD21	4015	114	2138	1764
ECBB21	4046	114	2158	1774
ECBC21	4030	115	2149	1767
ECBD21	4059	115	2171	1772
ECCC21	3957	110	2090	1757
ECCD21	3959	110	2097	1752
EDAA21	3908	110	2063	1735
EDAB21	3902	109	2054	1739
EDAC21	3962	111	2104	1747
EDBB21	3964	111	2105	1748
EDBC21	3980	111	2110	1759
EDBD21	3947	110	2088	1749
EDCC21	3963	110	2101	1751
GAAA21	3769	103	1942	1723
GAAB21	3796	105	1960	1731
GAAC21	3802	104	1970	1727
GAAD21	3839	106	1996	1738
GAAE21	3854	105	2013	1736
GABB21	3730	103	1911	1717
GABC21	3756	103	1936	1717
GABD21	3778	104	1957	1718
GACC21	3791	104	1968	1719
GACD21	3814	105	1983	1727
GBAA21	3751	103	1929	1719
GBAB21	3732	103	1913	1717
GBAC21	3757	103	1937	1716

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
GBAD21	3777	104	1954	1719
GBBB21	3724	102	1909	1713
GBBC21	3786	104	1962	1719
GBBD21	3806	104	1974	1727
GBCC21	3801	104	1974	1724
GCAA21	3709	102	1894	1713
GCAB21	3737	103	1922	1712
GCAC21	3757	103	1939	1715
GCAD21	3786	103	1960	1722
GCBB21	3761	103	1943	1715
GDAA21	3742	103	1928	1710
ABAE31	4417	126	2381	1911
BBAE31	4383	124	2356	1904
CBAE31	4362	123	2347	1893
DBAE31	4276	122	2308	1846
EBAE31	4126	120	2243	1763
ABAE32	4544	132	2491	1921
BBAE32	4496	130	2458	1908
CBAE32	4480	129	2449	1902
DBAE32	4388	127	2405	1855
EBAE32	4202	124	2314	1764
ABAE33	4664	137	2582	1945
BBAE33	4632	135	2557	1941
CBAE33	4579	133	2531	1916
DBAE33	4461	132	2489	1840
EBAE33	4236	126	2361	1749
ABAE41	4459	128	2419	1912
BBAE41	4418	126	2392	1900
CBAE41	4398	125	2379	1894
DBAE41	4311	124	2343	1844
EBAE41	4170	122	2286	1762
ABAE42	4598	134	2539	1926
BBAE42	4557	132	2511	1915
CBAE42	4530	131	2496	1904
DBAE42	4374	129	2442	1803
EBAE42	4258	127	2372	1760
ABAE43	4712	139	2640	1933
BBAE43	4681	138	2617	1926

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
CBAE43	4637	136	2591	1909
DBAE43	4512	136	2554	1822
EBAE43	4284	128	2413	1742
ABAE51	4487	130	2454	1903
BBAE51	4448	128	2430	1891
CBAE51	4425	127	2415	1883
DBAE51	4332	126	2371	1835
EBAE51	4174	123	2308	1742
ABAE52	4609	135	2557	1917
BBAE52	4584	134	2540	1911
CBAE52	4533	132	2512	1889
DBAE52	4377	131	2462	1785
EBAE52	4299	129	2413	1756
ABAE53	4743	141	2666	1936
BBAE53	4724	140	2653	1930
CBAE53	4672	138	2629	1904
DBAE53	4539	138	2583	1818
EBAE53	4391	134	2502	1755
ABAE61	4395	122	2348	1924
BBAE61	4375	121	2335	1918
CBAE61	4358	121	2328	1910
DBAE61	4211	120	2281	1809
EBAE61	4123	118	2244	1761
ABAE62	4567	129	2482	1956
BBAE62	4555	129	2474	1952
CBAE62	4507	127	2451	1928
DBAE62	4382	128	2416	1839
EBAE62	4162	119	2290	1754
ABAE63	4710	137	2595	1978
BBAE63	4658	134	2565	1958
CBAE63	4668	133	2564	1970
DBAE63	4552	134	2532	1886
EBAE63	4269	125	2384	1759
ABAE71	4363	124	2344	1896
BBAE71	4332	122	2323	1887
CBAE71	4303	120	2305	1877
DBAE71	4206	120	2271	1815
EBAE71	4053	117	2198	1737

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
ABAE72	4512	130	2470	1911
BBAE72	4484	129	2453	1903
CBAE72	4454	127	2436	1891
DBAE72	4365	127	2402	1835
EBAE72	4197	124	2319	1754
ABAE73	4645	136	2578	1930
BBAE73	4611	134	2556	1920
CBAE73	4601	134	2551	1917
DBAE73	4454	133	2499	1822
EBAE73	4345	130	2439	1776
ABAE81	4425	124	2380	1922
BBAE81	4404	123	2366	1915
CBAE81	4385	122	2356	1907
DBAE81	4213	121	2299	1793
EBAE81	3907	108	2082	1717
ABAE82	4588	131	2509	1948
BBAE82	4577	130	2502	1945
CBAE82	4525	129	2479	1917
DBAE82	4422	129	2450	1842
EBAE82	3992	113	2165	1714
ABAE83	4737	139	2626	1972
BBAE83	4716	136	2590	1990
CBAE83	4693	136	2596	1962
DBAE83	4584	136	2573	1875
EBAE83	4021	115	2192	1714
ABAE91	4389	125	2373	1891
BBAE91	4360	123	2355	1882
CBAE91	4331	122	2338	1872
DBAE91	4232	121	2302	1809
EBAE91	4075	118	2223	1733
ABAE92	4535	132	2494	1909
BBAE92	4509	130	2478	1901
CBAE92	4485	129	2464	1892
DBAE92	4394	128	2428	1837
EBAE92	4224	126	2351	1748
ABAE93	4672	138	2611	1922
BBAE93	4642	136	2590	1915
CBAE93	4598	135	2568	1895

Table 16-1. Average annual index of historic properties' effects over the 96-year simulation period.

Alternative	Total	Fort Peck Lake	Lake Sakakawea	Lake Oahe
DBAE93	4489	135	2533	1821
EBAE93	4257	126	2395	1736
EVQ2XX	4365	167	2593	1605

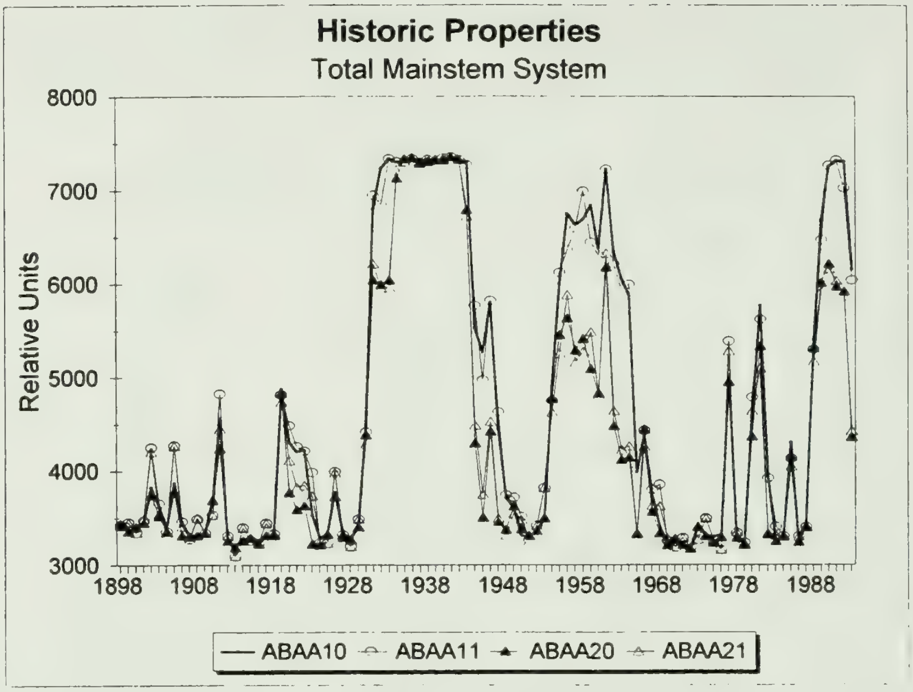

Figure 16-1. Annual average index of historic properties value in three upper mainstem lakes over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

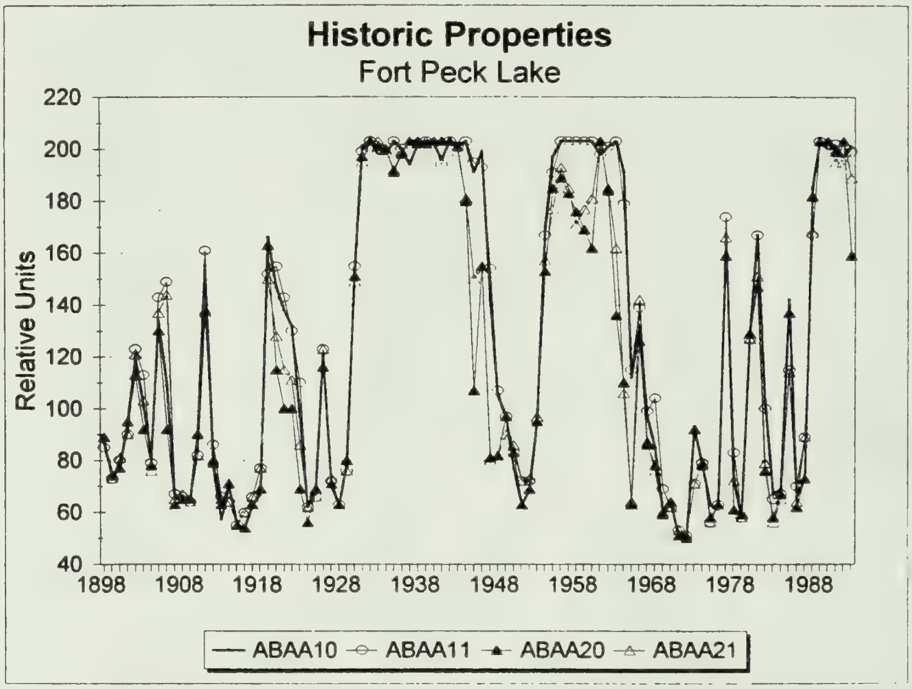

Figure 16-2. Annual average index of historic properties value in Fort Peck Lake over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

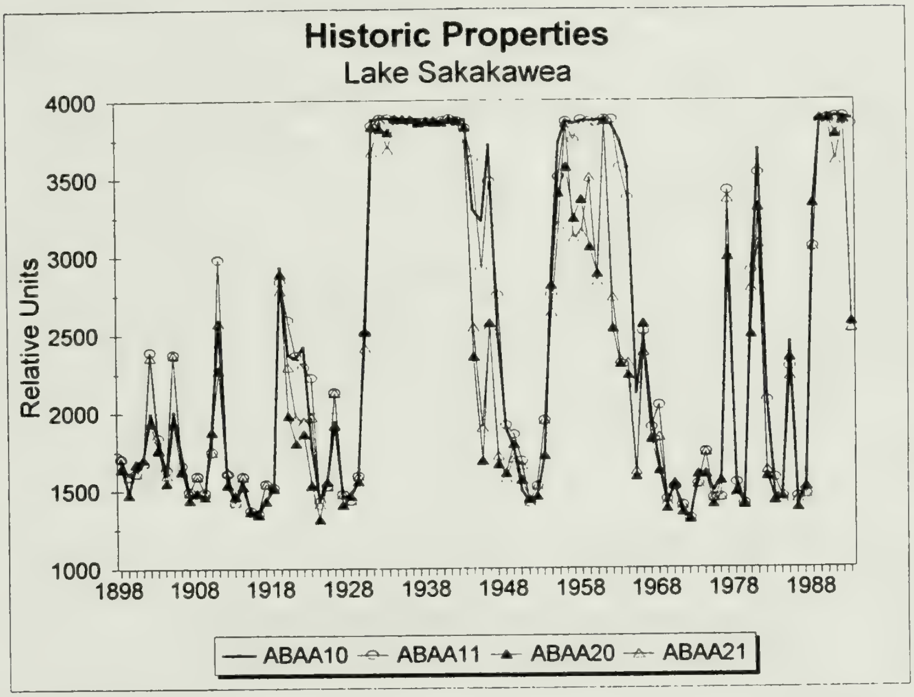

Figure 16-3. Annual average index of historic properties value in Lake Sakakawea over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

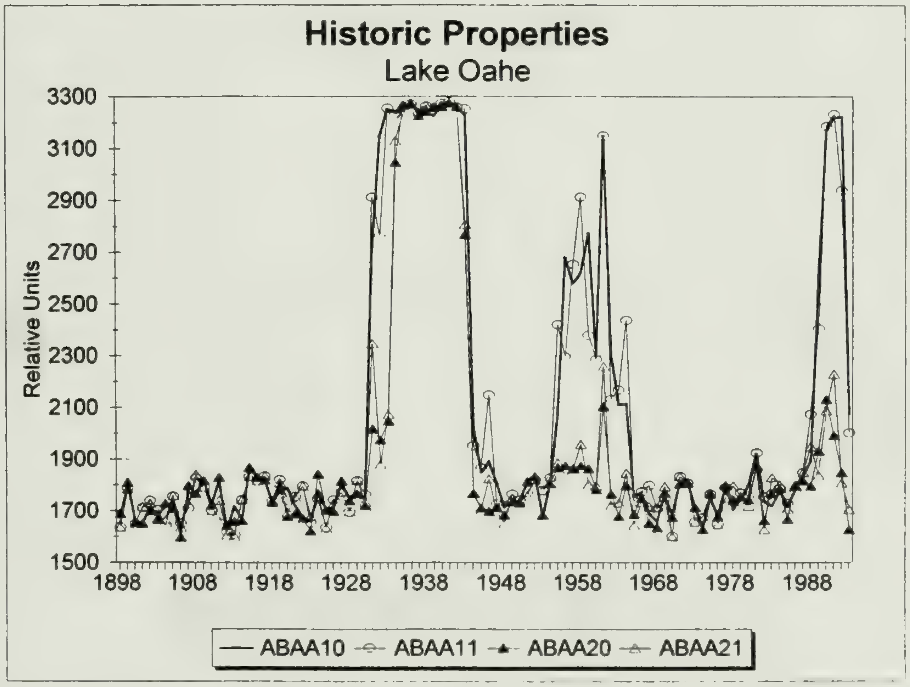

Figure 16-4. Annual average index of historic properties value in Lake Oahe over the 96-year simulation period for alternatives ABAA10, ABAA11, ABAA20, and ABAA21.

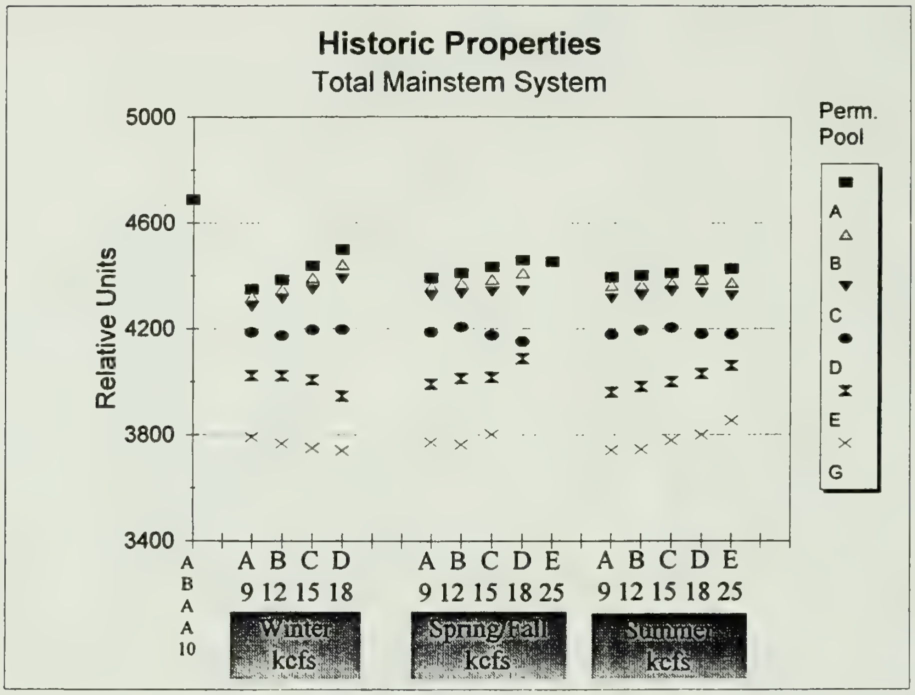

Figure 16-5. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period by nonnavigation service level.

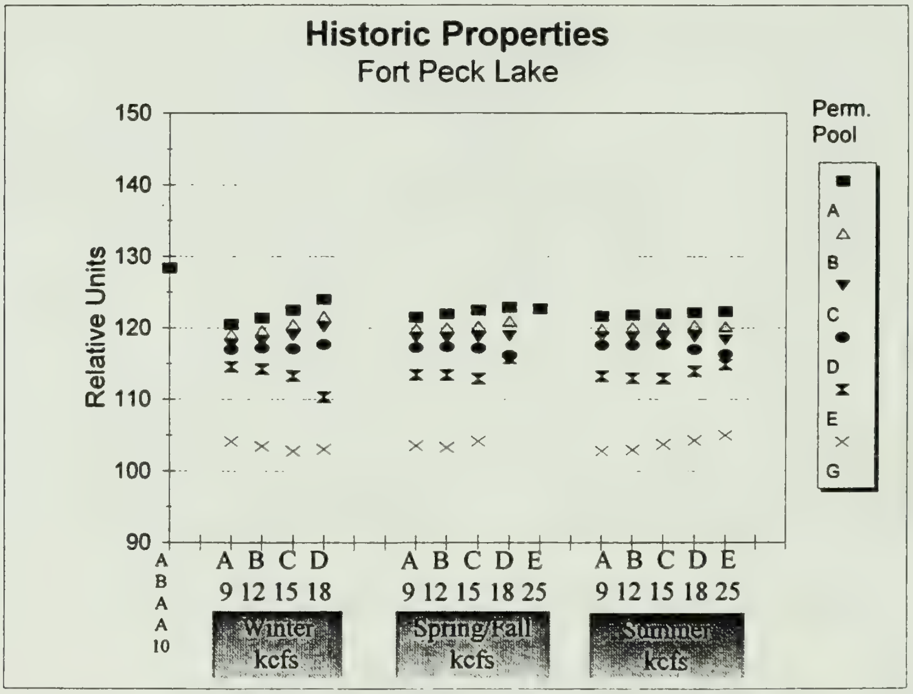

Figure 16-6. Annual average index of historic properties value in Fort Peck Lake over the 96-year simulation period by nonnavigation service level.

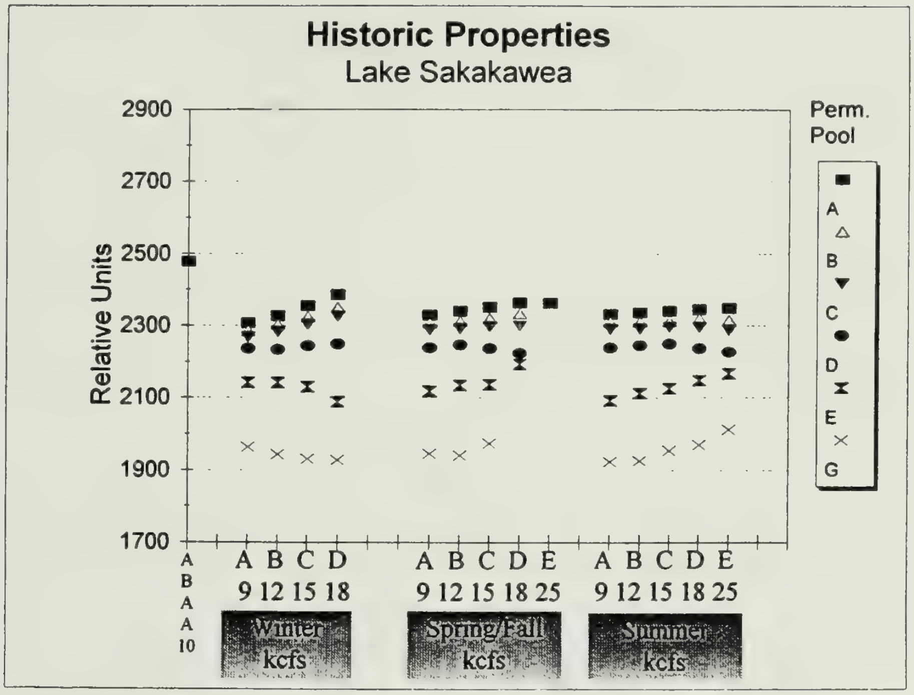

Figure 16-7. Annual average index of historic properties value in Lake Sakakawea over the 96-year simulation period by nonnavigation service level.

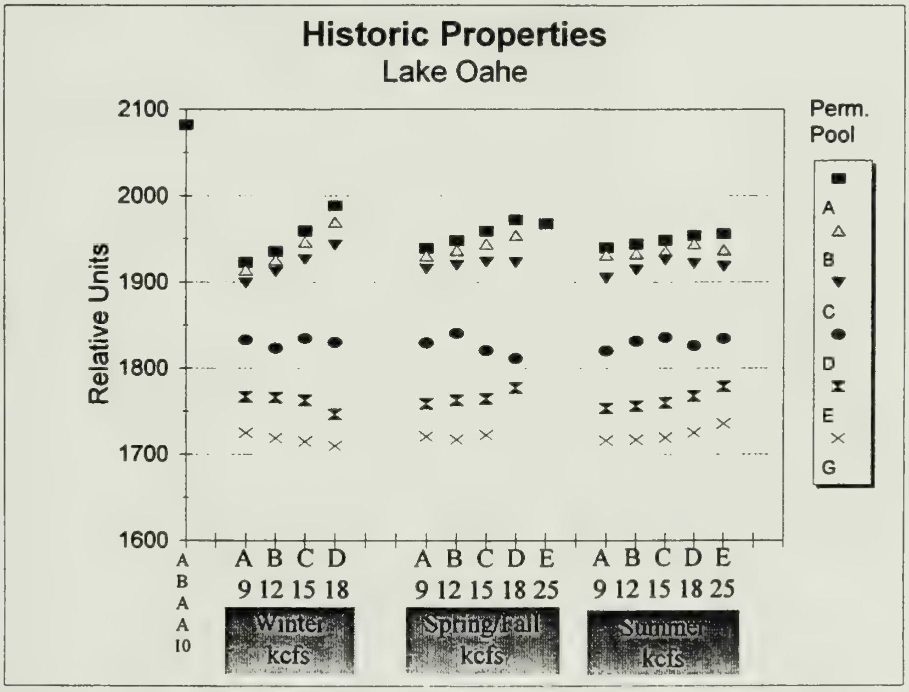

Figure 16-8. Annual average index of historic properties value in Lake Oahe over the 96-year simulation period by nonnavigation service level.

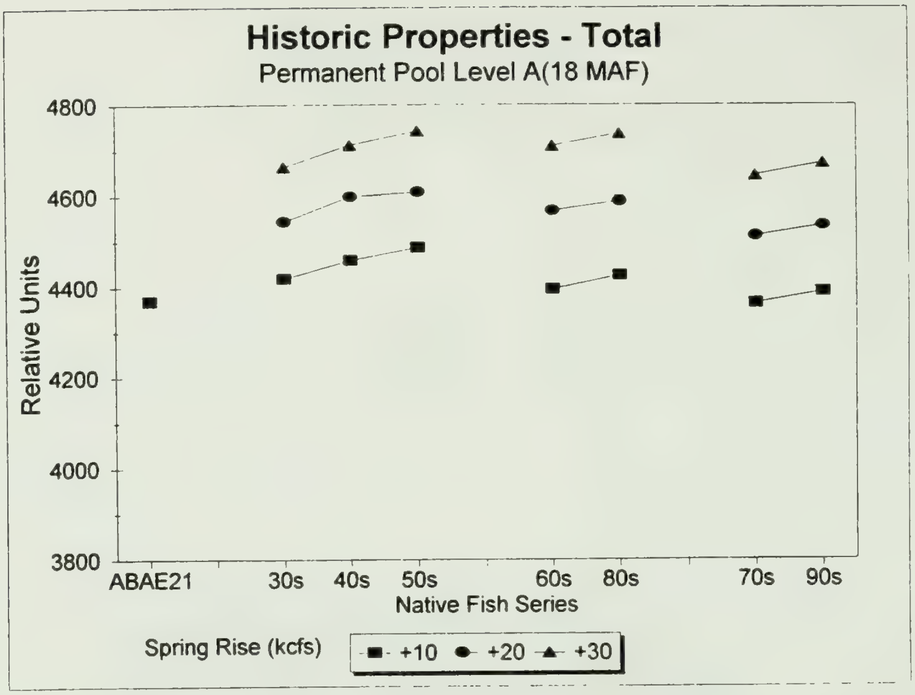

Figure 16-9. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 18-MAF permanent pool level.

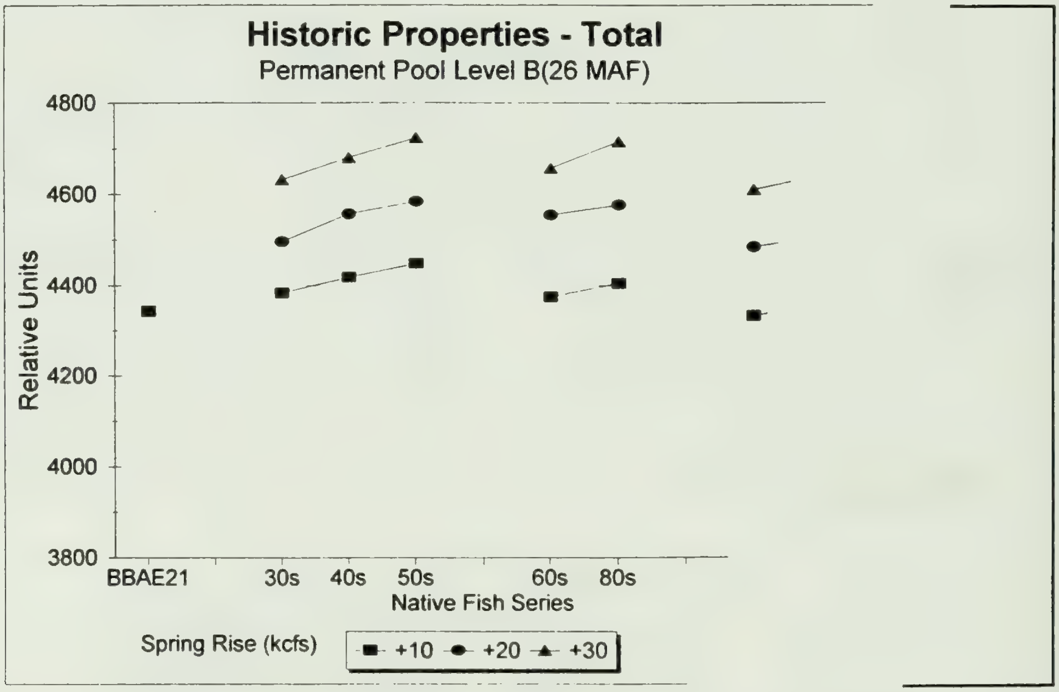

Figure 16-10. Annual average volume of coldwater fish habitat in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 26-MAF permanent pool level.

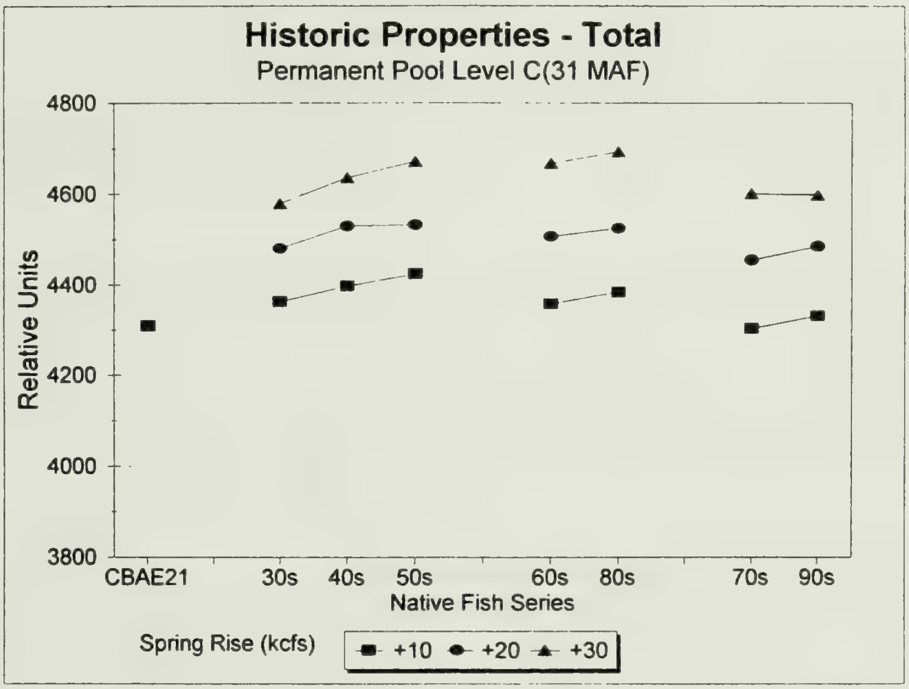

Figure 16-11. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 31-MAF permanent pool level.

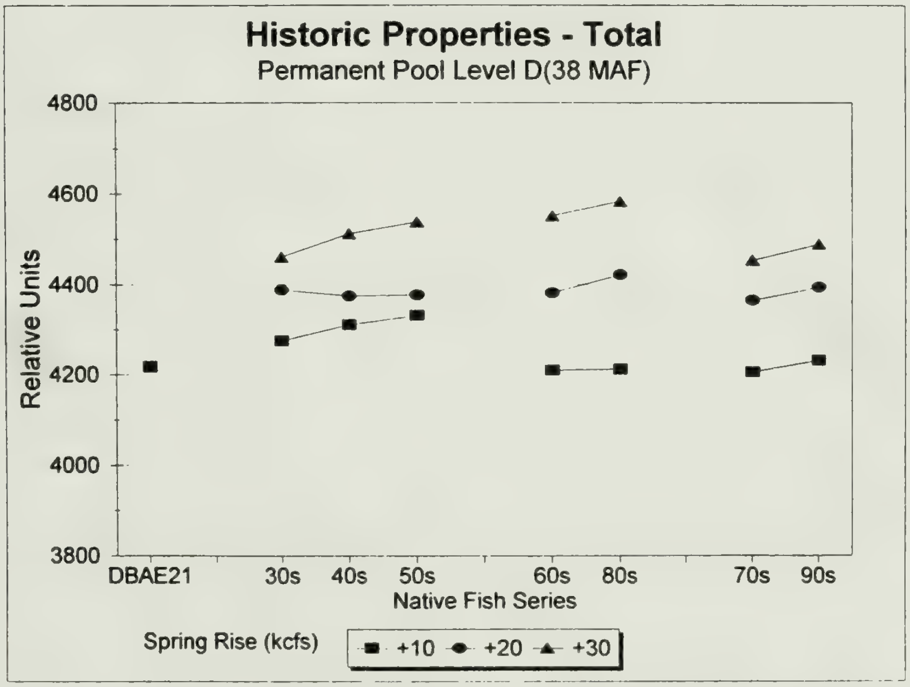

Figure 16-12. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 38-MAF permanent pool level.

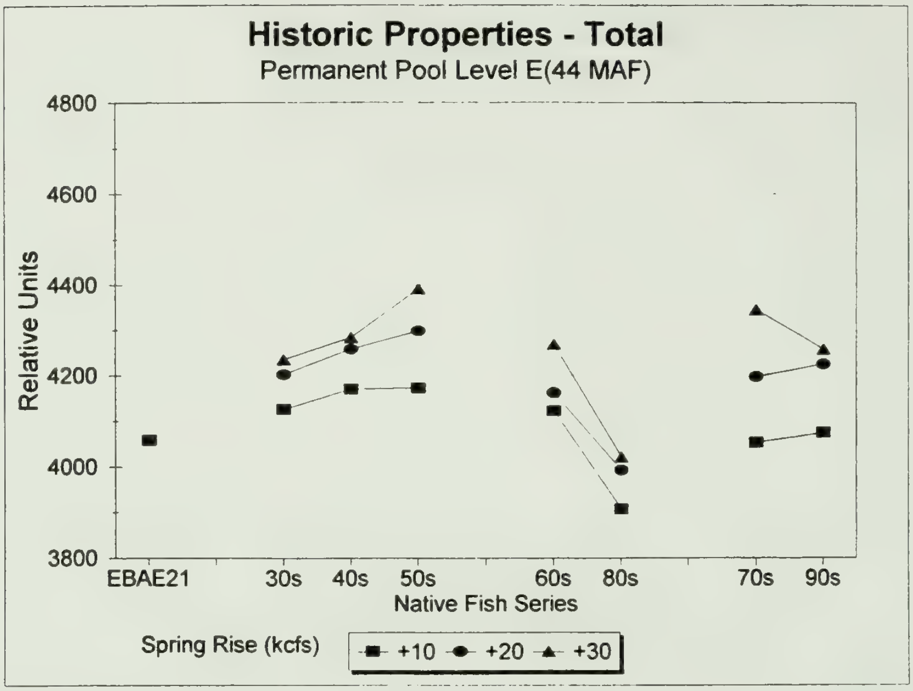

Figure 16-13. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period for Native Fish alternatives with 44-MAF permanent pool level.

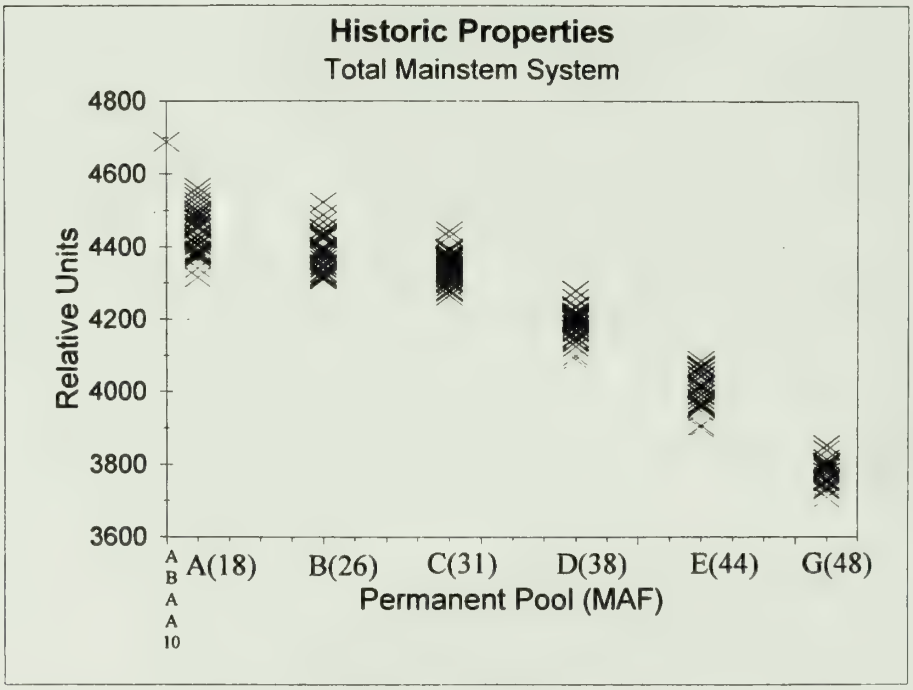

Figure 16-14. Annual average index of historic properties value in the six mainstem lakes over the 96-year simulation period for the Basic Set of alternatives for six permanent pool levels.

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ATTACHMENT A

SUMMARY TABLES

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ABAA10	44.4	17.7	619.8	546.2	75.7	1,304	1.96	9.9	59.0	108	49.4	155	187	432	4,689
ABAA20	44.2	16.9	625.2	547.5	78.5	1,312	1.98	10.9	59.7	106	47.2	156	194	387	4,319
ABAA11	44.1	17.7	618.7	546.1	75.4	1,302	2.00	10.1	59.5	105	50.9	154	184	542	4,711
AAAA21	43.9	17.1	627.6	519.7	78.7	1,287	2.04	11.1	59.8	102	47.4	158	192	549	4,317
AAAB21	43.9	17.1	627.6	519.7	78.7	1,287	2.04	11.1	59.8	102	47.4	158	192	549	4,317
AAAC21	43.9	17.1	627.6	519.7	78.7	1,287	2.04	11.1	59.8	102	47.4	158	192	549	4,317
AAAD21	43.9	17.1	627.6	519.7	78.7	1,287	2.04	11.1	59.8	102	47.4	158	192	549	4,317
AAAE21	43.9	17.1	627.6	519.7	78.7	1,287	2.04	11.1	59.8	102	47.4	158	192	549	4,317
AABB21	43.9	17.0	626.5	520.6	78.2	1,286	2.04	11.0	60.1	102	48.1	157	191	561	4,342
AABC21	43.9	17.0	626.5	520.6	78.2	1,286	2.04	11.0	60.1	102	48.1	157	191	561	4,342
AABD21	43.9	17.0	626.5	520.6	78.2	1,286	2.04	11.0	60.1	102	48.1	157	191	561	4,342
AABE21	43.9	17.0	626.5	520.6	78.2	1,286	2.04	11.0	60.1	102	48.2	157	191	561	4,342
AACC21	44.0	16.9	625.3	520.6	77.5	1,284	2.03	10.9	60.3	102	49.3	157	190	559	4,363
AACD21	44.0	16.9	625.3	520.6	77.5	1,284	2.03	10.9	60.3	102	49.3	157	190	559	4,363
AACE21	44.0	16.9	625.3	520.6	77.5	1,284	2.03	10.9	60.3	102	49.3	157	190	559	4,363
AADD21	43.9	16.6	625.3	521.2	77.7	1,285	2.03	10.9	60.3	102	48.5	160	190	573	4,373
AADE21	43.9	16.4	624.7	521.9	78.0	1,285	2.03	10.9	60.4	102	49.0	157	190	575	4,377
AAEE21	44.3	15.3	623.0	522.9	76.5	1,282	2.01	10.7	59.7	104	49.9	154	188	572	4,453
ABAA21	43.8	16.8	625.6	547.3	77.6	1,311	2.02	10.9	60.5	102	49.0	157	190	560	4,369
ABAB21	43.8	16.8	625.6	547.3	77.6	1,311	2.02	10.9	60.5	102	49.0	157	190	560	4,369
ABAC21	43.8	16.8	625.6	547.3	77.6	1,311	2.02	10.9	60.5	102	49.0	157	190	560	4,369
ABAD21	43.8	16.8	625.6	547.3	77.6	1,311	2.02	10.9	60.5	102	49.0	157	190	560	4,369
ABAE21	43.8	16.8	625.6	547.3	77.6	1,311	2.02	10.9	60.5	102	49.0	157	190	560	4,369
ABBB21	44.0	16.7	624.9	546.6	77.1	1,309	2.02	10.9	60.7	102	49.3	157	189	561	4,378
ABBC21	44.1	16.7	624.8	546.8	77.1	1,309	2.02	10.8	60.7	102	49.3	158	189	560	4,382
ABBD21	44.1	16.6	624.7	547.1	77.0	1,309	2.02	10.8	60.8	103	49.3	158	189	565	4,385
ABBE21	44.0	16.7	624.7	547.5	77.2	1,310	2.01	10.8	60.8	102	49.8	156	189	564	4,387
ABCC21	43.9	16.5	624.9	546.3	77.1	1,309	2.02	10.8	61.0	103	48.9	159	190	570	4,389
ABCD21	43.9	16.5	624.7	546.6	77.3	1,309	2.02	10.8	61.0	103	49.3	159	189	567	4,389
ABCE21	43.9	16.3	624.1	547.5	77.2	1,309	2.02	10.8	61.0	103	49.2	155	189	555	4,394
ABDD21	44.2	16.2	624.1	546.1	77.2	1,308	2.03	10.8	61.0	103	48.8	160	189	570	4,410
ABDE21	44.2	16.1	623.4	547.4	77.0	1,308	2.02	10.7	61.1	103	49.7	156	188	571	4,422
ACAA21	44.1	16.5	624.7	546.9	77.0	1,309	2.01	10.7	60.9	103	49.7	156	189	548	4,417
ACAB21	44.1	16.5	624.5	547.3	76.9	1,309	2.00	10.7	60.9	103	50.0	156	188	549	4,420
ACAC21	44.1	16.4	624.7	547.1	77.1	1,309	2.02	10.8	60.8	103	49.2	159	189	552	4,403
ACAD21	44.1	16.5	624.9	547.3	77.6	1,310	2.01	10.8	60.8	103	49.2	159	190	554	4,405
ACAE21	44.1	16.4	624.1	548.1	77.7	1,310	2.00	10.7	60.9	103	49.6	156	189	551	4,417
ACBB21	44.1	16.4	624.1	547.1	76.8	1,309	2.02	10.7	61.1	103	49.7	157	189	556	4,422
ACBC21	44.1	16.3	623.7	547.6	77.0	1,309	2.01	10.7	61.1	103	49.8	159	189	557	4,430
ACBD21	44.3	16.4	623.9	548.2	77.0	1,310	2.01	10.7	61.2	103	50.2	158	188	551	4,435
ACBE21	44.2	16.1	623.8	548.9	77.6	1,311	2.02	10.7	61.1	103	49.1	157	189	529	4,421
ACCC21	44.1	16.2	623.9	547.3	75.9	1,307	2.02	10.7	61.3	103	50.1	159	189	558	4,454
ACCD21	44.1	16.2	623.1	547.9	76.0	1,307	2.01	10.6	61.4	103	50.4	159	188	539	4,459
ACCE21	44.3	15.9	623.6	549.0	77.2	1,310	2.02	10.7	61.2	103	49.5	156	188	553	4,450

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ACDD21	44.3	15.9	622.8	547.4	75.6	1,306	2.02	10.6	61.5	103	49.9	159	188	553	4,483
ACDE21	44.3	15.6	622.1	549.0	76.8	1,308	2.00	10.6	61.6	104	50.5	157	187	545	4,499
ADAA21	44.3	16.2	624.2	545.7	76.2	1,307	2.01	10.6	60.4	103	50.4	158	188	560	4,473
ADAB21	44.3	16.2	623.9	546.3	76.0	1,307	2.01	10.6	60.4	103	50.5	159	188	564	4,477
ADAC21	44.3	16.1	624.5	546.1	76.3	1,307	2.01	10.7	60.3	103	49.9	160	188	576	4,459
ADAD21	44.3	16.1	624.0	546.9	76.0	1,307	2.00	10.6	60.4	103	49.8	159	189	549	4,465
ADAE21	44.4	15.8	623.9	547.7	77.3	1,309	2.01	10.6	60.3	103	49.4	157	189	558	4,459
ADBB21	44.3	16.0	623.6	546.5	75.8	1,306	2.02	10.6	60.7	103	50.8	158	187	582	4,494
ADBC21	44.3	16.0	623.1	547.0	75.5	1,306	2.01	10.5	60.7	103	50.9	159	188	573	4,501
ADBD21	44.4	15.8	624.2	547.2	76.4	1,308	2.02	10.6	60.6	103	49.3	160	188	556	4,475
ADBE21	44.4	15.7	623.0	548.8	76.1	1,308	2.01	10.6	60.6	103	50.0	157	188	565	4,489
ADCC21	44.2	15.7	623.4	546.0	76.1	1,305	2.01	10.6	60.8	103	50.2	159	188	550	4,512
ADCD21	44.3	15.7	623.2	547.2	76.3	1,307	2.00	10.5	60.8	104	50.8	159	187	582	4,524
ADCE21	44.4	15.5	621.7	548.9	75.5	1,306	1.99	10.4	60.9	104	50.7	155	186	534	4,538
ADDD21	44.4	15.5	622.3	546.7	76.0	1,305	2.00	10.5	61.0	104	50.7	156	187	563	4,548
ADDE21	44.7	14.7	622.2	548.9	76.7	1,307	1.99	10.4	61.0	104	49.4	154	187	517	4,563
ABAE31	43.5	16.4	623.3	547.1	77.9	1,308	2.03	10.9	61.7	100	54.2	164	188	536	4,417
ABAE32	42.8	15.9	620.0	546.7	77.6	1,303	2.01	10.5	63.1	97	58.3	168	186	576	4,544
ABAE33	42.0	15.3	615.3	546.2	77.2	1,296	2.01	10.1	64.3	92	61.3	175	183	621	4,664
ABAE41	42.7	16.1	622.2	547.0	78.0	1,306	2.00	10.8	62.5	97	54.2	165	186	529	4,459
ABAE42	42.1	15.6	618.9	546.6	77.5	1,301	1.98	10.3	63.7	94	58.4	169	185	565	4,598
ABAE43	41.3	14.9	614.9	546.2	77.1	1,294	1.99	10.0	64.6	90	62.3	182	183	625	4,712
ABAE51	39.7	14.9	622.1	547.0	77.5	1,301	1.96	10.6	63.1	97	53.5	166	186	522	4,487
ABAE52	39.4	14.3	619.8	546.4	77.6	1,297	1.96	10.3	64.2	94	57.6	169	185	529	4,609
ABAE53	38.9	13.9	615.2	546.0	77.3	1,291	1.97	9.9	65.1	90	60.6	178	183	584	4,743
ABAE61	42.8	13.0	624.6	538.2	76.6	1,295	2.06	11.8	63.4	97	52.8	168	187	560	4,395
ABAE62	42.1	12.2	619.9	536.4	76.0	1,287	2.06	11.2	64.9	94	58.2	175	184	572	4,567
ABAE63	41.1	11.7	616.8	535.5	75.9	1,281	2.03	10.8	65.7	91	61.5	182	182	637	4,710
ABAE71	42.6	14.3	623.7	547.2	78.0	1,306	2.02	10.9	64.0	96	53.9	165	188	506	4,363
ABAE72	41.8	14.0	619.5	546.6	77.7	1,300	2.02	10.4	65.6	93	59.7	170	185	569	4,512
ABAE73	41.0	13.3	615.5	546.2	77.2	1,293	2.02	10.0	66.5	88	62.2	180	184	625	4,645
ABAE81	40.0	12.6	624.3	537.5	76.7	1,291	2.03	11.6	63.9	96	51.8	167	187	558	4,425
ABAE82	39.6	11.9	619.8	536.3	76.0	1,284	2.03	11.1	65.3	93	57.9	172	184	576	4,588
ABAE83	39.0	11.4	615.9	535.4	75.9	1,278	2.01	10.6	66.0	91	61.8	178	182	644	4,737
ABAE91	39.4	14.3	623.7	547.1	78.2	1,303	1.98	10.8	64.6	95	53.7	166	187	517	4,389
ABAE92	39.2	13.7	619.4	546.5	77.8	1,297	1.99	10.3	66.1	92	60.1	167	185	531	4,535
ABAE93	38.5	13.1	614.9	546.2	77.2	1,290	1.99	9.8	67.0	89	62.1	177	184	620	4,672
BAAA21	43.7	17.1	627.9	520.0	78.8	1,288	2.03	11.1	59.8	102	47.8	158	192	560	4,309
BAAB21	43.7	17.1	627.9	520.0	78.8	1,288	2.03	11.1	59.8	102	47.8	158	192	560	4,309
BAAC21	43.7	17.1	627.9	520.0	78.8	1,288	2.03	11.1	59.8	102	47.8	158	192	560	4,309
BAAD21	43.7	17.1	627.9	520.0	78.8	1,288	2.03	11.1	59.8	102	47.8	158	192	560	4,309
BAAE21	43.7	17.1	627.9	520.0	78.8	1,288	2.03	11.1	59.8	102	47.8	158	192	560	4,309
BABB21	43.8	17.0	628.3	519.9	78.4	1,287	2.03	11.1	60.1	102	47.7	158	192	547	4,313

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BABC21	43.8	17.0	628.1	520.2	78.3	1,287	2.03	11.1	60.1	102	47.7	159	192	546	4,316
BABD21	43.8	17.0	627.8	520.4	78.5	1,287	2.03	11.1	60.1	102	48.0	160	192	557	4,319
BABE21	43.8	16.8	627.9	520.8	78.8	1,288	2.03	11.1	60.1	102	47.7	157	192	549	4,312
BACC21	43.8	16.8	627.9	520.4	78.3	1,287	2.04	11.1	60.2	102	47.8	161	191	572	4,321
BACD21	43.8	16.8	627.6	520.9	78.2	1,287	2.04	11.1	60.3	102	47.8	161	192	563	4,327
BACE21	43.8	16.6	627.4	521.6	78.5	1,288	2.04	11.1	60.3	102	47.7	158	191	576	4,331
BADD21	43.8	16.5	626.9	521.0	77.9	1,286	2.03	11.0	60.3	102	47.8	161	191	569	4,352
BADE21	43.8	16.1	627.0	522.0	78.2	1,287	2.04	11.0	60.3	102	48.1	158	191	578	4,345
BBAA21	43.8	16.8	628.0	546.1	78.4	1,313	2.03	11.0	60.4	102	48.2	158	191	551	4,342
BBAB21	43.7	16.8	628.7	545.5	78.6	1,313	2.04	11.1	60.3	102	47.3	158	192	541	4,316
BBAC21	43.7	16.8	628.3	546.0	78.5	1,313	2.03	11.1	60.4	102	47.6	160	192	539	4,323
BBAD21	43.8	16.7	628.1	546.5	78.4	1,314	2.03	11.0	60.4	102	47.5	160	192	536	4,330
BBAE21	43.8	16.7	627.5	547.1	78.1	1,313	2.02	11.0	60.4	102	48.0	157	192	535	4,343
BBBB21	43.8	16.7	627.4	545.8	78.1	1,312	2.03	11.0	60.7	102	47.8	158	191	535	4,344
BBBC21	43.8	16.7	627.6	546.4	78.0	1,312	2.03	11.0	60.7	102	48.1	160	191	548	4,353
BBBD21	43.7	16.7	627.2	546.9	77.7	1,312	2.02	11.0	60.8	103	48.3	159	191	566	4,362
BBBE21	43.9	16.2	627.8	547.4	77.8	1,313	2.04	11.0	60.6	102	47.4	157	191	558	4,333
BBCC21	43.7	16.3	627.3	545.3	78.1	1,311	2.04	11.0	60.9	102	48.2	159	190	552	4,350
BBCD21	43.7	16.3	627.6	546.1	78.4	1,312	2.02	11.0	60.9	103	48.0	159	191	570	4,363
BBCE21	43.8	16.0	626.8	547.4	78.1	1,312	2.03	10.9	60.9	103	48.0	157	190	568	4,362
BBDD21	44.1	16.0	627.1	545.5	77.8	1,310	2.03	10.9	60.9	103	48.0	159	190	561	4,373
BBDE21	44.0	15.7	626.0	547.5	77.5	1,311	2.02	10.9	61.0	103	48.7	155	190	577	4,395
BCAA21	43.9	16.6	627.1	545.8	78.0	1,311	2.03	10.9	60.7	103	48.8	158	190	563	4,379
BCAB21	43.9	16.5	626.8	546.4	77.9	1,312	2.02	10.9	60.7	103	49.2	158	190	561	4,386
BCAC21	43.9	16.5	626.5	546.9	77.5	1,311	2.01	10.8	60.8	103	49.7	159	190	564	4,391
BCAD21	43.9	16.4	627.1	546.9	77.5	1,312	2.02	10.9	60.7	103	48.6	159	190	572	4,371
BCAE21	44.0	16.1	626.8	547.8	77.8	1,313	2.02	10.9	60.6	102	48.2	157	190	533	4,365
BCBB21	43.9	16.5	627.3	546.4	78.2	1,312	2.02	10.9	61.0	103	48.9	159	190	556	4,396
BCBC21	43.9	16.2	627.6	546.3	78.0	1,312	2.02	10.9	61.0	103	48.2	159	190	561	4,382
BCBD21	43.9	16.2	626.9	547.4	78.0	1,312	2.01	10.8	61.0	103	48.7	159	190	561	4,391
BCBE21	43.9	15.9	626.0	548.8	77.7	1,312	2.01	10.8	61.0	103	48.5	157	190	526	4,390
BCCC21	44.0	15.9	627.6	545.4	77.7	1,311	2.04	10.9	61.1	103	48.2	159	190	560	4,382
BCCD21	44.0	15.9	626.6	546.9	77.4	1,311	2.03	10.8	61.2	103	48.3	159	190	548	4,400
BCCE21	44.3	15.2	627.3	548.7	78.7	1,314	2.02	10.9	61.0	103	47.5	155	191	552	4,389
BCDD21	44.0	15.7	625.6	546.7	77.6	1,310	2.02	10.8	61.4	103	49.2	160	189	555	4,447
BCDE21	44.4	15.1	626.2	548.9	77.9	1,312	2.01	10.8	61.4	103	48.0	155	190	552	4,436
BDAA21	43.9	16.3	627.8	544.3	78.2	1,311	1.99	10.8	60.1	105	50.0	158	190	505	4,423
BDAB21	44.0	16.0	626.7	544.8	77.9	1,309	2.02	10.8	60.2	103	49.2	159	189	567	4,422
BDAC21	44.0	16.1	626.5	545.4	77.6	1,310	2.01	10.8	60.2	103	49.2	159	189	553	4,432
BDAD21	44.1	15.8	627.5	545.6	77.8	1,311	2.03	10.9	60.1	103	48.5	158	189	568	4,399
BDAE21	44.0	15.7	626.3	547.5	78.1	1,312	2.01	10.8	60.1	103	49.0	158	189	568	4,427
BDBB21	44.0	15.9	627.6	544.4	78.2	1,310	2.03	10.8	60.4	103	48.7	158	190	578	4,439
BDBC21	44.1	15.8	626.8	545.3	77.6	1,310	2.03	10.8	60.4	103	48.9	158	189	568	4,424
BDBD21	44.1	15.6	627.4	546.3	78.2	1,312	2.02	10.8	60.4	103	48.5	159	189	564	4,429

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BDBE21	44.2	15.3	626.6	548.5	78.2	1,313	2.01	10.8	60.4	103	48.3	156	189	558	4,435
BDCC21	44.2	15.5	626.5	544.8	77.7	1,309	2.02	10.8	60.7	103	48.7	158	189	575	4,469
BDCD21	44.0	15.5	625.2	546.6	77.3	1,309	2.01	10.7	60.8	103	49.3	160	188	562	4,489
BDCE21	44.5	14.8	626.3	548.5	78.5	1,313	2.01	10.8	60.7	104	47.7	156	189	553	4,451
BDDD21	44.2	15.2	625.5	545.9	77.9	1,309	2.00	10.7	60.9	104	49.1	157	188	536	4,524
BBAE31	43.1	16.2	625.2	547.0	78.3	1,310	2.03	11.0	61.6	100	53.1	163	189	525	4,383
BBAE32	42.7	15.6	622.7	546.6	78.4	1,306	2.03	10.7	63.0	97	56.7	167	187	572	4,496
BBAE33	41.9	14.9	618.1	546.1	78.0	1,299	2.02	10.3	64.1	92	59.2	174	185	609	4,632
BBAE41	42.6	15.9	624.6	546.9	78.8	1,309	2.01	11.0	62.4	97	52.8	166	187	518	4,418
BBAE42	42.0	15.2	621.3	546.4	78.2	1,303	2.00	10.5	63.7	93	56.6	170	186	562	4,557
BBAE43	41.4	14.6	617.4	546.0	77.9	1,297	2.00	10.1	64.7	89	60.5	182	184	619	4,681
BBAE51	39.6	14.6	625.1	546.9	78.5	1,305	1.97	10.8	63.0	96	52.0	166	186	514	4,448
BBAE52	39.2	14.1	621.1	546.4	78.1	1,299	1.97	10.4	64.2	93	56.6	169	186	530	4,584
BBAE53	38.7	13.7	616.9	546.0	77.4	1,293	1.98	10.0	65.1	90	59.5	178	184	593	4,724
BBAE61	42.7	12.9	626.3	538.3	77.5	1,298	2.05	11.9	63.3	96	52.5	169	187	560	4,375
BBAE62	41.8	12.1	622.0	536.5	77.8	1,290	2.06	11.4	64.8	93	58.1	175	184	561	4,555
BBAE63	40.4	11.5	620.0	535.4	77.5	1,285	2.05	11.0	65.6	88	60.9	184	183	644	4,658
BBAE71	42.6	14.6	625.7	547.1	78.4	1,308	2.02	11.0	63.9	96	53.3	166	188	498	4,332
BBAE72	42.1	13.9	621.2	546.6	78.1	1,302	2.02	10.6	65.5	92	59.0	169	186	551	4,484
BBAE73	40.9	13.1	617.9	546.1	78.0	1,296	2.02	10.2	66.4	88	60.5	179	185	610	4,611
BBAE81	39.6	12.5	626.0	537.6	77.6	1,293	2.02	11.8	63.9	95	51.9	169	187	553	4,404
BBAE82	39.3	11.8	621.8	536.4	77.9	1,287	2.03	11.3	65.2	93	57.6	171	185	564	4,577
BBAE83	39.2	11.2	617.0	535.4	76.4	1,279	2.04	10.8	66.0	89	60.0	179	184	642	4,716
BBAE91	39.2	14.3	625.8	547.0	78.7	1,305	1.98	10.9	64.5	94	52.8	167	188	503	4,360
BBAE92	38.8	13.5	621.0	546.4	78.2	1,298	1.99	10.4	65.9	92	59.6	167	186	530	4,509
BBAE93	38.4	12.8	617.4	546.0	77.9	1,293	2.00	10.0	66.8	88	60.5	177	184	615	4,642
CAAA21	43.7	17.1	629.6	518.3	79.5	1,288	2.06	11.3	59.8	102	47.3	158	193	552	4,266
CAAB21	43.6	17.1	629.4	517.3	79.5	1,287	2.05	11.2	59.8	102	47.5	159	192	566	4,275
CAAC21	43.7	17.1	629.3	517.5	79.2	1,287	2.05	11.2	59.8	102	47.5	161	192	571	4,281
CAAD21	43.7	17.1	629.1	517.8	79.4	1,287	2.05	11.2	59.8	102	47.3	160	193	564	4,284
CAAE21	43.7	16.9	629.2	519.3	79.0	1,288	2.05	11.2	59.8	102	47.0	158	193	563	4,278
CABB21	43.7	16.7	629.6	518.5	79.5	1,288	2.05	11.3	60.1	102	46.9	159	193	573	4,254
CABC21	43.8	16.7	629.6	518.8	79.0	1,288	2.05	11.3	60.1	102	46.9	159	193	572	4,268
CABD21	43.8	16.8	629.5	519.4	79.2	1,289	2.05	11.3	60.0	102	47.0	159	193	560	4,276
CABE21	43.9	16.6	629.2	520.0	79.2	1,289	2.05	11.2	60.1	102	46.9	156	193	562	4,284
CACC21	43.9	16.7	628.6	519.0	78.8	1,287	2.05	11.2	60.3	102	47.2	160	192	559	4,301
CACD21	43.9	16.6	629.0	519.4	78.9	1,288	2.05	11.2	60.3	102	46.7	160	192	567	4,290
CACE21	44.0	16.2	628.3	520.8	78.8	1,288	2.05	11.2	60.3	102	47.0	157	192	541	4,300
CADD21	43.9	16.4	628.4	519.0	79.1	1,287	2.05	11.2	60.3	102	47.0	159	192	566	4,319
CADE21	44.0	15.9	628.3	521.5	78.7	1,288	2.04	11.2	60.3	102	46.6	156	192	568	4,307
CBAA21	43.9	16.9	628.9	544.6	78.9	1,313	2.04	11.2	60.4	102	47.4	159	192	533	4,305
CBAB21	43.8	16.6	629.2	544.4	79.0	1,313	2.04	11.2	60.3	102	47.0	159	192	551	4,283
CBAC21	43.9	16.7	628.9	545.2	78.8	1,313	2.04	11.2	60.4	102	47.0	161	192	539	4,294

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CBAD21	43.9	16.7	628.9	546.0	79.0	1,315	2.04	11.2	60.3	102	47.3	160	192	526	4,301
CBAE21	43.9	16.5	628.5	547.0	79.0	1,315	2.03	11.1	60.4	102	47.2	157	192	532	4,310
CBBB21	43.9	16.6	628.5	544.9	78.8	1,313	2.05	11.2	60.6	102	47.3	159	192	532	4,317
CBBC21	44.0	16.8	628.4	545.7	78.8	1,314	2.04	11.2	60.7	102	47.5	160	192	537	4,325
CBBD21	43.9	16.5	628.6	545.9	78.6	1,314	2.04	11.2	60.7	102	47.0	160	192	546	4,316
CBBE21	44.0	16.0	628.8	547.2	79.1	1,315	2.05	11.2	60.6	102	46.6	157	192	546	4,309
CBCC21	44.1	16.1	628.7	544.8	78.8	1,312	2.05	11.2	60.9	102	47.0	160	192	536	4,323
CBCD21	44.1	16.2	628.2	546.1	78.8	1,313	2.03	11.1	60.9	102	47.2	159	191	545	4,339
CBCE21	44.2	15.7	628.4	547.4	78.5	1,314	2.03	11.2	60.8	102	46.7	156	192	520	4,320
CBDD21	43.9	15.6	629.0	545.5	79.5	1,314	2.05	11.3	61.0	102	46.8	157	192	576	4,301
CBDE21	44.4	15.2	627.9	547.4	78.8	1,314	2.04	11.1	61.0	103	46.7	155	191	576	4,335
CCAA21	44.1	16.6	628.5	544.4	78.9	1,312	2.04	11.1	60.6	102	48.1	157	191	545	4,322
CCAB21	44.0	16.6	628.1	545.4	78.7	1,313	2.03	11.1	60.7	102	48.4	158	190	543	4,342
CCAC21	44.0	16.5	627.8	546.1	78.4	1,313	2.02	11.0	60.7	102	48.7	158	190	550	4,358
CCAD21	44.1	16.3	627.8	546.4	78.3	1,313	2.02	11.0	60.7	102	48.2	158	190	555	4,348
CCAE21	44.2	15.8	628.4	547.6	78.9	1,315	2.03	11.1	60.5	102	47.6	156	191	548	4,335
CCBB21	44.1	16.5	628.6	546.2	79.0	1,314	2.04	11.1	61.0	102	47.9	157	191	554	4,345
CCBC21	44.1	16.0	628.4	546.2	78.5	1,313	2.04	11.1	61.0	102	48.0	158	191	560	4,354
CCBD21	44.1	16.1	628.0	547.1	78.5	1,314	2.03	11.0	61.0	102	48.3	158	190	569	4,371
CCBE21	44.2	15.5	628.6	548.6	79.0	1,316	2.03	11.1	60.9	103	47.2	156	191	540	4,342
CCCC21	44.0	15.8	628.6	544.8	78.2	1,311	2.05	11.1	61.1	102	47.6	158	191	576	4,358
CCCD21	44.0	15.8	629.5	546.9	79.3	1,315	2.03	11.2	61.1	102	47.2	158	192	553	4,331
CCCE21	44.4	15.1	628.5	548.8	79.1	1,316	2.03	11.0	61.1	103	46.8	155	191	564	4,357
CCDD21	44.3	15.4	628.9	545.5	78.8	1,313	2.03	11.1	61.3	102	46.9	158	191	572	4,364
CDAA21	44.2	16.4	628.7	543.1	79.1	1,311	2.04	11.0	60.1	103	48.3	157	190	578	4,365
CDAB21	44.2	16.3	628.2	544.4	78.8	1,312	2.03	11.0	60.1	103	48.4	158	190	576	4,388
CDAC21	44.2	16.0	628.3	544.6	78.4	1,311	2.02	11.0	60.1	103	48.3	159	190	592	4,390
CDAD21	44.1	15.8	628.7	545.1	78.5	1,312	2.03	11.0	60.0	102	47.8	159	191	590	4,363
CDAE21	44.2	15.4	628.4	547.2	79.0	1,314	2.02	11.0	59.9	103	47.1	156	191	537	4,370
CDBB21	44.2	15.8	628.3	544.6	78.7	1,312	2.04	11.0	60.4	102	48.4	158	190	563	4,392
CDBC21	44.1	15.7	628.1	544.7	78.1	1,311	2.04	11.0	60.4	103	48.0	158	191	579	4,396
CDBD21	44.2	15.5	628.7	546.8	79.2	1,314	2.03	11.1	60.4	103	47.2	157	191	555	4,376
CDBE21	44.6	15.1	628.5	548.5	79.1	1,316	2.02	11.0	60.3	103	46.3	156	191	558	4,382
CDCC21	44.3	15.5	628.0	544.9	78.6	1,311	2.01	11.0	60.6	103	48.1	158	190	541	4,444
CDCD21	44.2	15.1	628.7	545.1	78.8	1,312	2.05	11.1	60.6	103	47.2	157	191	593	4,374
CDDD21	44.4	14.9	627.8	545.1	79.1	1,311	2.04	11.0	60.9	104	47.0	157	190	575	4,429
CBAE31	43.4	16.0	626.6	547.1	78.9	1,312	2.03	11.1	61.5	100	51.9	163	190	501	4,362
CBAE32	42.6	15.5	623.5	546.6	78.3	1,306	2.02	10.8	63.1	97	56.2	169	188	548	4,480
CBAE33	41.7	14.5	619.7	546.3	78.3	1,300	2.03	10.5	64.2	90	58.1	177	185	606	4,579
CBAE41	42.6	15.8	625.5	546.9	78.7	1,309	2.00	11.0	62.4	96	52.2	166	188	507	4,398
CBAE42	41.9	15.1	622.4	546.4	78.5	1,304	1.99	10.6	63.7	93	56.0	170	187	546	4,530
CBAE43	41.2	14.4	619.7	546.4	78.5	1,300	2.00	10.3	64.7	89	59.2	183	185	605	4,637
CBAE51	39.5	14.5	626.1	546.9	79.1	1,306	1.97	10.9	63.0	95	51.5	168	187	508	4,425
CBAE52	38.7	13.8	623.3	546.6	78.7	1,301	1.98	10.6	64.2	92	56.4	170	186	525	4,533

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CBAE53	38.1	13.4	619.3	546.2	78.3	1,295	1.99	10.2	65.3	88	59.3	181	185	588	4,672
CBAE61	42.5	12.9	627.4	538.0	78.6	1,299	2.06	12.0	63.2	96	52.0	169	188	557	4,358
CBAE62	41.4	12.0	623.9	537.2	78.6	1,293	2.05	11.7	64.7	93	56.1	176	187	533	4,507
CBAE63	40.2	11.5	621.0	536.1	78.3	1,287	2.03	11.2	65.7	89	59.3	184	185	600	4,668
CBAE71	42.3	14.4	627.0	547.5	79.0	1,310	2.02	11.2	63.8	95	52.2	164	189	477	4,303
CBAE72	41.5	13.6	622.5	546.9	78.6	1,303	2.02	10.7	65.4	91	58.1	169	187	534	4,454
CBAE73	40.3	12.9	618.6	546.0	78.2	1,296	2.02	10.2	66.3	87	60.1	180	185	603	4,601
CBAE81	39.4	12.4	627.2	537.5	78.7	1,295	2.03	11.9	63.8	95	51.1	170	188	547	4,385
CBAE82	38.8	11.8	623.9	536.9	79.0	1,290	2.02	11.6	65.1	93	54.9	173	187	544	4,525
CBAE83	38.3	11.2	620.2	536.1	78.6	1,284	2.01	11.1	66.0	89	59.4	179	184	608	4,693
CBAE91	38.8	14.0	627.2	547.4	79.2	1,307	1.98	11.1	64.4	94	51.9	166	188	495	4,331
CBAE92	38.4	13.3	622.2	546.8	78.7	1,299	2.00	10.6	65.9	91	58.7	168	186	513	4,485
CBAE93	37.8	12.5	619.1	546.3	78.4	1,294	2.01	10.2	66.7	87	59.3	178	185	611	4,598
DAAA21	43.4	17.0	631.5	518.3	80.2	1,290	2.06	11.5	59.7	101	46.9	158	193	569	4,185
DAAB21	43.5	17.0	631.4	518.7	80.1	1,291	2.06	11.4	59.7	102	46.7	158	194	564	4,204
DAAC21	43.3	16.8	631.3	518.7	79.7	1,290	2.06	11.4	59.7	101	46.5	160	194	573	4,195
DAAD21	43.5	17.0	631.4	519.4	80.2	1,291	2.05	11.5	59.8	101	46.6	160	193	553	4,180
DAAE21	43.5	16.9	631.1	520.1	79.9	1,291	2.05	11.4	59.8	102	46.4	157	194	559	4,222
DABB21	43.4	16.9	631.2	518.4	79.9	1,290	2.07	11.5	60.0	101	46.8	159	193	550	4,190
DABC21	43.6	16.9	630.8	519.4	79.8	1,291	2.06	11.4	60.1	102	46.5	159	193	550	4,212
DABD21	43.3	16.4	632.7	522.4	79.6	1,295	2.01	11.4	59.9	103	47.8	159	194	512	4,185
DABE21	43.2	16.0	630.8	521.1	79.7	1,291	2.05	11.4	60.0	100	45.9	157	194	574	4,199
DACC21	43.3	16.2	631.4	518.9	80.1	1,290	2.06	11.6	60.2	101	45.3	160	194	557	4,153
DACD21	43.3	16.2	631.4	518.9	80.1	1,290	2.07	11.6	60.2	101	45.7	160	194	557	4,150
DACE21	43.4	15.7	631.1	522.1	80.1	1,292	2.06	11.5	60.1	101	44.9	155	194	569	4,174
DADD21	43.5	15.8	631.3	520.5	80.0	1,291	2.06	11.6	60.3	101	45.4	159	194	585	4,169
DBAA21	43.4	16.3	631.8	542.5	80.3	1,314	2.09	11.6	60.2	101	45.7	159	194	548	4,127
DBAB21	43.5	16.3	631.8	544.0	80.4	1,316	2.06	11.6	60.2	101	45.7	159	194	537	4,145
DBAC21	43.4	16.3	631.6	545.3	80.2	1,317	2.05	11.6	60.2	100	45.8	161	194	520	4,153
DBAD21	43.4	16.2	631.6	546.1	80.2	1,318	2.05	11.5	60.3	100	45.4	160	194	526	4,154
DBAE21	43.3	15.9	630.8	547.7	79.7	1,317	2.04	11.4	60.2	100	46.1	158	193	530	4,218
DBBB21	43.4	16.3	631.2	544.7	79.9	1,315	2.06	11.5	60.5	101	45.8	160	194	530	4,173
DBBC21	43.4	16.1	631.4	545.2	80.1	1,316	2.06	11.5	60.6	101	45.5	160	194	537	4,167
DBBD21	43.4	16.0	630.8	546.4	79.8	1,316	2.05	11.5	60.6	100	45.8	161	194	534	4,197
DBBE21	43.5	15.5	631.5	548.5	80.2	1,319	2.07	11.5	60.4	101	44.6	157	194	548	4,170
DBCC21	43.4	15.9	630.6	545.0	79.8	1,315	2.05	11.4	60.8	101	46.4	160	193	541	4,237
DBCD21	43.6	15.7	631.7	545.4	80.0	1,316	2.07	11.6	60.7	101	45.4	160	194	561	4,163
DBDD21	43.6	15.3	631.2	545.2	79.9	1,315	2.07	11.6	60.9	101	45.0	157	194	565	4,185
DCAA21	43.4	16.2	631.6	543.3	80.0	1,314	2.06	11.5	60.4	101	46.5	157	193	539	4,180
DCAB21	43.5	16.2	631.3	545.1	79.8	1,316	2.04	11.4	60.4	101	46.5	159	193	528	4,208
DCAC21	43.4	16.0	631.6	545.6	79.8	1,316	2.04	11.4	60.5	101	46.3	159	193	544	4,201
DCAD21	43.3	15.9	631.0	546.8	79.7	1,317	2.03	11.4	60.5	101	46.6	159	193	542	4,234
DCAE21	43.4	15.4	631.6	548.6	80.0	1,319	2.05	11.5	60.2	101	44.9	156	194	560	4,180

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DCBB21	43.6	16.0	630.8	544.6	79.8	1,315	2.06	11.5	60.6	101	46.9	156	193	556	4,213
DCBC21	43.5	15.7	630.5	545.8	79.6	1,315	2.06	11.4	60.8	101	46.9	157	193	556	4,238
DCBD21	43.7	15.9	630.5	547.4	79.6	1,317	2.04	11.3	60.8	102	46.9	158	192	552	4,279
DCBE21	43.6	14.3	632.5	549.2	80.4	1,320	2.07	11.6	60.3	102	43.6	156	194	532	4,125
DCCC21	43.8	15.5	631.7	544.5	79.6	1,315	2.06	11.5	60.9	101	46.1	158	193	590	4,211
DCCD21	43.6	15.1	631.9	546.4	79.9	1,317	2.08	11.5	60.9	101	45.4	158	193	574	4,181
DCDD21	43.9	14.4	632.2	544.9	80.3	1,316	2.09	11.7	60.9	102	43.5	158	195	553	4,101
DDAA21	43.6	15.8	630.7	541.0	79.7	1,311	2.07	11.4	59.7	102	46.9	156	192	586	4,216
DDAB21	43.3	15.4	632.2	541.9	79.8	1,313	2.09	11.6	59.7	101	46.0	157	194	575	4,141
DDAC21	43.6	15.4	631.5	544.1	79.6	1,314	2.05	11.4	59.9	101	46.5	158	192	563	4,202
DDAD21	43.8	15.3	631.4	545.6	79.6	1,316	2.05	11.4	59.8	101	46.5	158	192	574	4,233
DDAE21	43.7	14.2	632.7	547.7	80.7	1,319	2.06	11.5	59.4	102	43.4	157	195	519	4,138
DDBB21	43.7	15.4	630.6	543.1	79.4	1,312	2.06	11.3	60.1	101	47.0	156	192	589	4,281
DDBC21	43.8	15.3	631.1	544.6	79.5	1,314	2.05	11.4	60.3	101	46.6	158	192	602	4,258
DDBD21	44.0	15.1	632.0	546.0	80.0	1,317	2.06	11.5	60.2	102	45.7	157	193	595	4,197
DDCC21	43.8	14.9	631.6	543.3	79.8	1,313	2.07	11.5	60.4	102	46.1	157	192	602	4,214
DDCD21	43.9	14.4	632.6	544.5	80.5	1,316	2.09	11.7	60.1	102	43.0	158	195	551	4,091
DBAE31	42.7	15.5	628.4	547.4	79.9	1,314	2.04	11.4	61.3	100	50.3	164	191	484	4,276
DBAE32	42.0	14.9	625.3	546.9	79.4	1,309	2.02	11.1	62.8	96	55.1	168	190	519	4,388
DBAE33	41.4	14.1	622.8	546.7	79.5	1,305	2.04	10.9	63.8	91	57.3	177	187	591	4,461
DBAE41	42.0	15.3	627.4	547.3	79.8	1,312	2.01	11.3	62.2	96	51.0	166	189	471	4,311
DBAE42	41.2	14.4	625.7	547.2	79.7	1,308	2.02	11.1	63.4	92	54.5	173	189	523	4,374
DBAE43	40.4	13.9	622.5	546.7	79.6	1,303	2.02	10.7	64.4	88	57.3	184	187	616	4,512
DBAE51	38.9	13.9	628.0	547.3	80.0	1,308	1.97	11.2	62.8	95	50.0	168	189	479	4,332
DBAE52	38.1	13.2	625.9	547.3	79.9	1,304	1.98	11.1	64.0	92	53.8	170	189	462	4,377
DBAE53	37.8	13.1	622.1	546.7	79.4	1,299	1.99	10.6	65.0	88	57.7	181	186	566	4,539
DBAE61	42.0	12.5	630.1	539.2	79.6	1,303	2.07	12.5	63.0	96	50.6	170	190	521	4,211
DBAE62	41.0	11.8	625.9	537.5	79.2	1,295	2.07	12.0	64.4	92	56.3	176	187	561	4,382
DBAE63	40.0	11.2	622.3	536.3	79.1	1,289	2.06	11.4	65.4	88	58.8	185	185	635	4,552
DBAE71	42.0	13.9	629.0	547.9	80.0	1,313	2.03	11.5	63.6	94	50.2	164	191	448	4,206
DBAE72	40.9	13.2	624.5	547.2	79.5	1,305	2.04	11.1	65.0	91	56.5	168	188	512	4,365
DBAE73	39.8	12.5	621.9	546.8	79.3	1,300	2.05	10.7	66.0	86	58.2	181	187	597	4,454
DBAE81	38.8	12.0	630.0	538.6	79.8	1,299	2.04	12.5	63.7	95	49.6	169	190	526	4,213
DBAE82	38.5	11.6	625.6	537.5	79.2	1,292	2.03	11.8	64.9	92	56.3	175	187	541	4,422
DBAE83	37.7	10.9	621.2	536.5	78.9	1,285	2.01	11.4	65.9	89	57.5	180	186	581	4,584
DBAE91	38.4	13.4	629.3	547.7	80.1	1,309	2.00	11.4	64.2	94	49.8	164	190	462	4,232
DBAE92	38.6	12.8	624.5	547.1	79.6	1,303	2.01	10.9	65.5	91	56.6	166	188	499	4,394
DBAE93	37.2	12.2	621.5	546.8	79.4	1,297	2.02	10.5	66.4	87	58.8	179	186	592	4,489
EAAA21	43.1	15.9	634.2	516.0	80.4	1,289	2.17	12.1	59.4	99	44.5	159	197	530	3,959
EAAB21	43.1	15.9	633.9	518.2	80.4	1,292	2.15	12.0	59.4	99	44.8	161	196	534	3,972
EAAC21	43.2	16.0	633.6	518.4	80.4	1,292	2.12	12.0	59.6	100	44.9	161	196	537	3,994
EAAD21	43.1	15.9	633.3	521.7	80.3	1,294	2.11	11.9	59.7	100	44.8	161	196	538	4,005
EAAE21	43.1	15.9	632.8	521.0	80.2	1,293	2.08	11.7	59.7	100	45.0	157	196	560	4,070

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EABB21	42.9	15.7	633.5	516.9	80.3	1,289	2.15	12.0	59.8	100	44.8	159	196	538	3,994
EABC21	43.2	15.9	633.1	521.1	80.1	1,293	2.12	11.9	60.0	100	44.6	160	196	538	4,017
EABD21	42.7	15.7	633.7	521.9	80.2	1,294	2.11	11.9	59.9	101	44.3	159	196	539	4,015
EABE21	43.6	15.8	632.9	521.9	80.4	1,295	2.07	11.8	59.9	101	44.2	157	196	553	4,056
EACC21	43.2	15.8	632.4	518.6	80.1	1,290	2.10	11.8	60.3	100	44.5	158	196	553	4,055
EACD21	43.3	16.0	633.1	520.3	80.1	1,293	2.08	11.8	60.3	101	45.1	159	196	541	4,070
EADD21	43.6	15.5	632.0	520.2	80.2	1,292	2.09	11.8	60.4	101	44.6	157	195	552	4,087
EBAA21	42.9	15.8	633.9	539.3	80.3	1,312	2.15	12.0	59.9	100	44.8	158	196	544	3,991
EBAB21	42.8	15.6	633.7	542.3	80.3	1,315	2.14	12.0	60.0	100	45.0	159	196	534	4,005
EBAC21	43.5	15.4	634.1	543.2	80.4	1,317	2.13	12.0	60.0	100	44.0	161	196	553	3,969
EBAD21	43.3	15.8	632.7	545.8	80.1	1,318	2.09	11.8	60.3	100	44.9	159	196	532	4,043
EBAE21	43.5	15.6	633.2	547.8	80.5	1,321	2.07	11.8	60.0	101	44.5	156	195	528	4,059
EBBB21	43.5	15.4	633.7	541.7	80.4	1,315	2.14	12.1	60.3	100	43.8	159	197	550	3,981
EBBC21	43.4	15.6	633.5	543.6	80.3	1,316	2.10	11.9	60.5	101	43.8	160	196	548	4,012
EBBD21	43.5	15.5	633.0	546.2	80.1	1,318	2.09	11.8	60.6	101	44.9	159	195	529	4,066
EBCC21	43.4	15.3	633.2	543.4	80.3	1,315	2.13	12.0	60.6	101	44.1	158	196	585	4,030
EBCD21	43.7	15.2	632.7	545.6	80.1	1,317	2.09	11.8	60.8	101	44.7	158	195	560	4,074
ECAA21	43.3	15.6	633.5	538.7	80.7	1,312	2.12	12.0	60.1	100	44.4	159	196	556	3,982
ECAB21	43.4	15.5	633.5	541.6	80.4	1,314	2.11	12.0	60.1	100	44.3	160	196	544	3,995
ECAC21	43.8	15.4	633.7	543.9	80.2	1,317	2.11	11.9	60.2	101	44.5	159	196	550	4,022
ECAD21	43.8	15.2	633.7	545.5	80.4	1,319	2.11	12.0	60.1	100	44.5	159	195	572	4,015
ECBB21	43.5	15.5	633.2	542.7	80.3	1,315	2.10	11.9	60.6	101	44.5	159	196	532	4,046
ECBC21	43.8	15.2	633.4	544.2	80.4	1,317	2.12	12.0	60.5	100	44.6	159	195	575	4,030
ECBD21	44.0	15.1	633.4	546.6	80.4	1,320	2.10	11.8	60.6	101	44.9	158	195	546	4,059
ECCC21	44.2	14.6	633.9	541.7	80.7	1,315	2.14	12.1	60.3	101	42.6	158	197	532	3,957
ECCD21	44.1	14.6	633.6	545.0	80.8	1,318	2.13	12.1	60.5	101	42.8	158	197	546	3,959
EDAA21	43.8	15.2	633.9	535.2	81.1	1,309	2.16	12.2	59.1	101	42.7	159	197	569	3,908
EDAB21	43.8	14.7	634.5	537.7	80.8	1,311	2.16	12.2	58.9	101	42.7	160	197	566	3,902
EDAC21	43.8	14.7	633.7	540.7	80.9	1,314	2.14	12.1	59.2	100	42.6	162	197	532	3,962
EDBB21	43.8	14.7	633.6	538.6	80.8	1,312	2.17	12.1	59.3	100	42.6	161	197	567	3,964
EDBC21	44.1	14.5	633.9	541.8	80.7	1,315	2.15	12.0	59.7	101	42.7	158	197	555	3,980
EDBD21	44.1	14.5	634.1	544.6	80.9	1,318	2.14	12.1	59.7	101	42.5	159	197	540	3,947
EDCC21	44.1	14.5	633.9	541.0	80.7	1,314	2.14	12.1	59.9	101	42.5	160	196	575	3,963
EBAE31	42.4	15.2	630.2	547.7	80.2	1,316	2.06	11.8	61.3	99	49.0	164	193	501	4,126
EBAE32	41.5	14.2	628.0	546.9	79.9	1,310	2.07	11.6	62.7	94	54.0	169	192	571	4,202
EBAE33	41.1	13.1	625.4	546.4	80.1	1,306	2.07	11.4	63.8	90	54.2	175	191	549	4,236
EBAE41	42.0	14.9	629.2	547.6	80.3	1,314	2.04	11.7	62.1	95	49.5	167	191	490	4,170
EBAE42	40.7	13.9	627.0	546.6	80.0	1,308	2.03	11.4	63.4	91	53.8	169	190	528	4,258
EBAE43	40.3	12.9	624.6	546.5	80.0	1,304	2.03	11.2	64.2	88	54.1	180	191	543	4,284
EBAE51	38.6	13.3	630.6	547.7	80.6	1,311	2.01	11.6	62.7	94	49.8	166	190	486	4,174
EBAE52	37.9	12.8	627.1	547.2	80.1	1,305	2.00	11.3	63.9	91	54.6	168	190	504	4,299
EBAE53	37.3	12.3	623.7	546.9	79.8	1,300	2.02	11.0	64.8	88	57.3	180	188	605	4,391
EBAE61	41.9	12.2	630.7	539.2	80.2	1,304	2.09	12.8	63.1	96	49.0	168	192	518	4,123
EBAE62	41.2	11.2	627.5	537.6	79.9	1,297	2.08	12.6	64.4	93	51.8	173	193	549	4,162

Table A-1. Economic benefits and environmental resource values for 384 alternatives averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EBAE63	39.6	10.6	624.6	536.3	79.7	1,291	2.11	12.2	65.3	87	55.9	185	191	599	4,269
EBAE71	41.8	13.6	630.9	547.6	80.6	1,314	2.06	11.9	63.4	94	49.8	166	192	490	4,053
EBAE72	40.6	12.9	626.7	546.8	80.0	1,307	2.07	11.5	64.7	91	56.1	169	191	565	4,197
EBAE73	39.5	12.4	622.7	546.7	79.6	1,301	2.04	11.0	65.6	87	57.4	180	188	592	4,345
EBAE81	39.1	11.6	631.9	538.1	81.0	1,302	2.08	13.2	63.4	96	45.2	168	195	550	3,907
EBAE82	38.1	9.7	628.4	536.0	80.6	1,293	2.14	13.2	64.2	94	52.2	170	193	608	3,992
EBAE83	37.5	8.8	625.9	535.2	80.6	1,288	2.15	13.0	64.8	90	54.8	180	189	568	4,021
EBAE91	38.2	13.2	631.4	547.4	80.6	1,311	2.03	11.9	64.0	93	48.5	168	192	501	4,075
EBAE92	37.5	12.6	626.9	546.8	80.1	1,304	2.04	11.4	65.2	90	55.6	168	191	536	4,224
EBAE93	37.7	11.7	624.1	546.4	79.9	1,300	2.03	11.1	65.9	88	54.1	176	191	563	4,257
GAAA21	43.1	16.2	634.8	510.9	80.8	1,286	2.12	12.4	60.1	99	43.5	160	199	507	3,769
GAAB21	43.1	15.5	635.1	513.5	80.6	1,288	2.17	12.5	59.8	98	43.3	162	200	513	3,796
GAAC21	43.2	15.4	635.0	515.4	80.7	1,290	2.14	12.4	60.0	98	43.5	163	200	500	3,802
GAAD21	43.3	15.5	635.2	517.1	80.4	1,291	2.14	12.2	60.0	98	44.4	163	198	560	3,839
GAAE21	43.0	15.1	634.5	518.0	80.7	1,291	2.11	12.2	60.0	100	44.2	157	198	544	3,854
GABB21	42.9	15.0	635.5	515.4	80.9	1,290	2.20	12.5	59.8	98	42.8	161	200	490	3,730
GABC21	43.1	14.9	635.2	518.7	80.8	1,293	2.18	12.5	59.9	98	42.6	163	200	479	3,756
GABD21	42.6	14.9	634.9	521.0	80.9	1,294	2.14	12.4	60.2	98	42.7	163	200	470	3,778
GACC21	42.8	14.9	634.6	518.8	80.8	1,292	2.15	12.4	60.4	99	42.6	163	200	490	3,791
GACD21	43.3	14.8	634.5	519.6	80.8	1,293	2.15	12.3	60.3	98	42.5	163	199	487	3,814
GBAA21	42.5	15.1	635.0	535.2	80.8	1,309	2.20	12.5	60.0	99	43.4	160	200	529	3,751
GBAB21	42.6	15.1	635.2	538.9	81.0	1,313	2.17	12.5	60.1	99	43.1	161	200	478	3,732
GBAC21	42.9	15.0	635.1	541.0	81.0	1,315	2.16	12.4	60.2	99	43.1	163	200	468	3,757
GBAD21	42.5	15.1	634.8	543.9	81.0	1,317	2.12	12.3	60.5	99	43.2	164	199	463	3,777
GBBB21	42.9	14.7	635.3	537.5	81.0	1,311	2.22	12.5	59.9	98	42.8	162	201	494	3,724
GBBC21	42.7	15.0	634.7	541.8	80.9	1,315	2.14	12.4	60.9	100	42.9	163	200	474	3,786
GBBD21	43.3	14.9	634.7	544.5	80.9	1,318	2.13	12.3	60.8	101	42.8	162	199	481	3,806
GBCC21	43.0	14.4	635.1	540.8	80.8	1,314	2.17	12.3	60.4	99	42.6	164	200	498	3,801
GCAA21	42.8	15.0	635.3	534.0	81.1	1,308	2.23	12.6	59.5	98	42.9	161	201	512	3,709
GCAB21	43.2	14.5	635.6	537.3	81.1	1,312	2.20	12.5	59.7	99	42.5	162	201	493	3,737
GCAC21	42.9	14.4	635.5	540.7	81.0	1,314	2.18	12.4	59.7	100	42.8	162	200	488	3,757
GCAD21	42.8	14.4	635.2	544.1	81.0	1,317	2.15	12.3	59.9	99	42.8	164	200	476	3,786
GCBB21	42.9	14.3	635.5	538.0	81.0	1,312	2.20	12.5	60.1	100	42.7	160	200	502	3,761
GDAA21	43.5	14.3	635.0	531.9	81.3	1,306	2.21	12.5	58.8	99	42.8	161	201	538	3,742
EVQ2	0.0	-2.9	238.2	489.5	80.9	806	1.89	11.4	70.8	79	57.8	186	177	1450	4,365
POWER3	34.3	13.5	643.8	521.2	77.2	1,290	2.09	12.5	64.4	88	60.3	152	199	427	3,518

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ABAA10	57.8	11.6	547.6	550.2	60.2	1,227	1.66	5.3	60.6	122	67.8	144	161	390	6,221
ABAA20	57.8	11.0	563.2	555.8	68.8	1,257	1.59	6.4	61.4	120	64.9	145	172	329	5,767
ABAA11	57.7	11.6	546.6	550.0	60.8	1,227	1.76	5.3	60.6	119	71.2	142	154	563	6,232
AAAA21	57.2	11.7	570.7	475.7	70.8	1,186	1.75	7.2	59.9	115	60.4	147	172	572	5,679
AAAB21	57.2	11.7	570.7	475.7	70.8	1,186	1.75	7.2	59.9	115	60.4	147	172	572	5,679
AAAC21	57.2	11.7	570.7	475.7	70.8	1,186	1.75	7.2	59.9	115	60.4	147	172	572	5,679
AAAD21	57.2	11.7	570.7	475.7	70.8	1,186	1.75	7.2	59.9	115	60.4	147	172	572	5,679
AAAE21	57.2	11.7	570.7	475.7	70.8	1,186	1.75	7.2	59.9	115	60.4	147	172	572	5,679
AABB21	57.3	11.3	565.4	479.0	69.2	1,182	1.73	6.9	61.1	116	63.1	146	170	579	5,751
AABC21	57.3	11.3	565.4	479.0	69.2	1,182	1.73	6.9	61.1	116	63.1	146	170	579	5,751
AABD21	57.3	11.3	565.4	479.0	69.2	1,182	1.73	6.9	61.1	116	63.1	146	170	579	5,751
AABE21	57.3	11.3	565.4	479.0	69.2	1,182	1.73	6.9	61.1	116	63.1	146	170	579	5,751
AACC21	57.4	11.1	560.5	478.2	65.9	1,173	1.72	6.6	61.9	116	68.7	147	166	579	5,818
AACD21	57.4	11.1	560.5	478.2	65.9	1,173	1.72	6.6	61.9	116	68.7	147	166	579	5,818
AACE21	57.4	11.1	560.5	478.2	65.9	1,173	1.72	6.6	61.9	116	68.7	147	166	579	5,818
AADD21	57.2	10.1	561.4	481.1	67.1	1,177	1.74	6.7	62.0	117	64.7	147	167	604	5,802
AADE21	57.2	9.2	558.4	484.2	68.2	1,177	1.75	6.5	62.3	117	67.0	144	165	611	5,817
AAEE21	57.9	5.1	552.9	486.6	62.2	1,165	1.75	6.1	60.5	120	68.3	136	158	627	5,926
ABAA21	57.1	11.0	562.7	555.4	66.7	1,253	1.69	6.5	61.7	116	67.1	146	166	564	5,792
ABAB21	57.1	11.0	562.7	555.4	66.7	1,253	1.69	6.5	61.7	116	67.1	146	166	564	5,792
ABAC21	57.1	11.0	562.7	555.4	66.7	1,253	1.69	6.5	61.7	116	67.1	146	166	564	5,792
ABAD21	57.1	11.0	562.7	555.4	66.7	1,253	1.69	6.5	61.7	116	67.1	146	166	564	5,792
ABAE21	57.1	11.0	562.7	555.4	66.7	1,253	1.69	6.5	61.7	116	67.0	146	166	564	5,792
ABBB21	57.1	10.8	560.4	553.0	64.5	1,246	1.74	6.6	62.3	117	66.9	146	165	597	5,784
ABBC21	57.2	10.6	559.9	554.2	64.3	1,246	1.73	6.5	62.4	117	67.0	146	165	592	5,800
ABBD21	57.2	10.5	559.4	555.4	63.9	1,246	1.72	6.5	62.5	117	67.0	147	165	600	5,813
ABBE21	57.1	10.6	559.3	557.3	65.1	1,249	1.71	6.4	62.6	117	69.4	144	163	608	5,823
ABCC21	57.3	9.9	560.1	551.9	64.8	1,244	1.74	6.5	63.2	117	64.9	145	167	605	5,819
ABCD21	57.2	10.0	559.3	553.5	65.7	1,246	1.74	6.4	63.2	117	66.7	146	165	603	5,821
ABCE21	57.2	9.2	556.5	557.2	65.0	1,245	1.75	6.3	63.3	117	66.4	142	164	551	5,845
ABDD21	57.4	8.7	557.6	551.1	65.6	1,240	1.80	6.5	63.7	117	64.6	148	164	611	5,812
ABDE21	57.5	8.2	554.4	557.2	64.3	1,242	1.77	6.3	63.8	118	68.3	143	161	617	5,867
ACAA21	57.3	10.2	560.2	551.9	64.3	1,244	1.73	6.3	62.8	118	67.9	144	164	541	5,865
ACAB21	57.3	10.1	559.3	553.6	64.0	1,244	1.71	6.3	62.9	118	69.9	145	162	542	5,875
ACAC21	57.1	9.9	560.3	552.9	64.8	1,245	1.76	6.5	62.6	117	65.7	147	166	560	5,802
ACAD21	57.3	10.0	561.2	553.6	67.0	1,249	1.72	6.4	62.3	117	65.5	145	167	566	5,811
ACAE21	57.3	9.6	557.7	557.2	67.4	1,249	1.70	6.2	62.8	117	67.6	143	165	553	5,863
ACBB21	57.3	9.8	557.9	552.6	63.5	1,241	1.76	6.3	63.4	117	67.6	145	163	577	5,837
ACBC21	57.3	9.6	556.2	555.0	64.7	1,243	1.74	6.2	63.6	117	68.3	146	164	583	5,874
ACBD21	57.8	9.7	557.2	557.6	64.8	1,247	1.73	6.2	64.0	118	70.0	146	162	556	5,898
ACBE21	57.7	8.5	556.5	560.5	67.4	1,251	1.76	6.3	63.4	117	65.1	144	165	499	5,835
ACCC21	57.4	8.8	557.9	553.4	60.0	1,237	1.78	6.3	64.3	117	68.7	146	163	618	5,888
ACCD21	57.3	9.0	554.0	556.4	60.3	1,237	1.74	6.2	64.5	118	69.9	148	162	577	5,910
ACCE21	57.8	7.5	556.7	561.2	65.8	1,249	1.78	6.3	63.9	118	65.9	141	162	591	5,872

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ACDD21	57.8	7.7	553.6	553.7	58.4	1,231	1.80	6.3	64.9	117	67.0	147	160	596	5,909
ACDE21	57.8	6.7	550.2	561.2	63.9	1,240	1.74	6.0	65.2	120	69.5	140	158	540	5,984
ADAA21	57.6	9.5	559.7	546.1	61.1	1,234	1.78	6.4	62.1	118	69.6	147	163	570	5,926
ADAB21	57.6	9.4	558.4	549.3	60.1	1,235	1.75	6.2	62.2	118	70.1	148	162	590	5,944
ADAC21	57.6	8.9	561.0	548.4	61.4	1,237	1.78	6.4	61.8	117	67.4	150	163	643	5,864
ADAD21	57.6	8.7	558.7	552.0	60.2	1,237	1.75	6.3	62.1	117	66.9	148	165	567	5,892
ADAE21	58.0	7.7	558.2	555.6	66.3	1,246	1.77	6.3	61.6	117	65.0	144	165	561	5,866
ADBB21	57.6	8.6	556.6	549.5	59.2	1,232	1.81	6.3	63.0	118	70.0	147	160	659	5,926
ADBC21	57.6	8.4	554.4	552.3	57.8	1,231	1.77	6.1	63.2	118	70.5	147	161	642	5,959
ADBD21	57.8	7.9	559.4	553.1	62.1	1,240	1.83	6.5	62.4	118	63.4	148	164	580	5,839
ADBE21	58.0	7.3	554.1	560.5	60.6	1,240	1.77	6.2	62.6	118	66.5	143	162	579	5,902
ADCC21	57.6	7.5	556.5	547.5	61.4	1,230	1.81	6.3	63.5	118	67.3	148	163	569	5,903
ADCD21	57.6	7.7	555.7	552.7	62.6	1,236	1.76	6.2	63.6	119	70.0	150	160	661	5,955
ADCE21	58.0	6.6	549.0	560.6	58.7	1,233	1.73	5.8	63.7	121	69.5	140	158	483	6,021
ADDD21	57.9	6.8	553.2	527.9	61.9	1,208	1.79	6.2	64.2	121	69.7	145	159	568	5,935
ADDE21	59.0	4.8	552.9	538.1	64.8	1,220	1.73	5.9	64.3	121	63.1	139	161	441	6,027
ABAE31	56.3	10.8	560.2	555.4	67.9	1,251	1.72	6.6	62.9	112	71.1	156	166	478	5,786
ABAE32	54.9	10.5	557.5	555.1	67.1	1,245	1.70	6.3	63.7	109	74.1	160	164	602	5,868
ABAE33	54.8	10.1	551.8	554.6	65.9	1,237	1.70	6.1	64.2	106	77.0	164	161	580	5,998
ABAE41	55.6	10.6	559.3	555.4	67.7	1,249	1.70	6.5	63.2	111	71.2	155	165	528	5,828
ABAE42	54.9	10.4	556.2	554.9	66.7	1,243	1.69	6.2	64.0	107	73.3	161	164	608	5,922
ABAE43	54.6	10.0	550.0	554.5	65.5	1,235	1.68	5.8	64.4	104	75.3	173	162	572	6,068
ABAE51	54.0	10.5	555.6	555.3	64.7	1,240	1.69	6.3	63.4	110	68.8	153	164	510	5,858
ABAE52	53.4	9.3	558.0	554.5	66.9	1,242	1.70	6.4	64.1	106	68.3	160	163	542	5,915
ABAE53	53.5	8.9	554.1	554.1	66.2	1,237	1.71	6.0	64.2	104	70.1	167	161	522	6,034
ABAE61	55.3	6.8	561.9	540.7	63.0	1,228	1.88	7.7	64.1	109	61.3	160	166	446	5,651
ABAE62	54.2	6.2	557.3	538.3	61.7	1,218	1.89	7.3	65.0	106	63.2	167	165	559	5,792
ABAE63	53.3	6.3	552.2	538.0	61.8	1,212	1.77	6.5	65.3	107	66.6	167	161	499	6,033
ABAE71	55.4	9.7	560.8	555.6	68.2	1,250	1.72	6.6	64.0	109	69.9	154	167	469	5,750
ABAE72	54.1	9.0	558.3	555.0	68.0	1,244	1.72	6.4	65.0	106	70.9	159	165	608	5,836
ABAE73	53.3	8.7	553.4	554.9	66.5	1,237	1.71	6.0	65.4	101	75.1	171	163	634	5,959
ABAE81	53.7	6.8	561.8	538.9	62.9	1,224	1.88	7.7	64.3	109	61.0	157	166	500	5,661
ABAE82	53.0	6.0	557.0	538.2	61.2	1,215	1.89	7.0	65.2	106	63.3	163	164	582	5,825
ABAE83	52.3	6.3	550.2	538.0	61.3	1,208	1.76	6.4	65.3	107	66.1	163	160	538	6,065
ABAE91	53.6	9.4	560.5	555.5	68.1	1,247	1.72	6.6	64.3	109	69.6	155	166	547	5,758
ABAE92	52.8	9.0	558.4	555.0	67.9	1,243	1.71	6.4	65.1	105	71.8	155	164	599	5,841
ABAE93	52.1	8.8	551.9	554.8	66.1	1,234	1.70	5.9	65.5	102	75.6	167	162	623	5,985
BAAA21	57.2	11.6	571.3	476.6	71.2	1,188	1.72	7.2	59.8	115	61.7	147	172	585	5,666
BAAB21	57.2	11.6	571.3	476.6	71.2	1,188	1.72	7.2	59.8	115	61.7	147	172	585	5,666
BAAC21	57.2	11.6	571.3	476.6	71.2	1,188	1.72	7.2	59.8	115	61.7	147	172	585	5,666
BAAD21	57.2	11.6	571.3	476.6	71.2	1,188	1.72	7.2	59.8	115	61.7	147	172	585	5,666
BAAE21	57.2	11.6	571.3	476.6	71.2	1,188	1.72	7.2	59.8	115	61.7	147	172	585	5,666
BABB21	57.3	11.2	573.7	475.3	69.5	1,187	1.75	7.3	60.7	116	60.9	147	171	502	5,647

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BABC21	57.3	11.2	572.9	476.5	69.1	1,187	1.73	7.2	60.8	116	61.1	149	171	497	5,658
BABD21	57.3	11.2	571.7	477.7	70.0	1,188	1.73	7.2	60.8	116	62.3	149	171	551	5,673
BABE21	57.3	10.6	572.1	479.3	71.5	1,191	1.74	7.2	60.7	116	60.2	146	170	513	5,643
BACC21	57.3	10.7	571.9	476.3	69.1	1,185	1.80	7.3	61.2	116	61.5	150	170	567	5,650
BACD21	57.3	10.6	570.6	478.7	68.7	1,186	1.77	7.2	61.3	116	61.3	150	171	524	5,677
BACE21	57.3	9.8	569.9	481.9	70.0	1,189	1.76	7.1	61.4	116	60.7	146	170	585	5,691
BADD21	57.4	9.7	568.0	479.6	67.6	1,182	1.78	7.1	61.9	116	61.5	150	170	576	5,719
BADE21	57.3	7.8	568.5	484.2	69.0	1,187	1.80	7.1	61.6	117	62.5	146	167	615	5,687
BBAA21	57.3	11.1	573.2	550.0	70.0	1,262	1.75	7.2	61.0	116	63.1	148	170	583	5,690
BBAB21	57.1	10.9	576.1	546.5	70.8	1,261	1.81	7.4	60.7	116	59.2	147	172	555	5,572
BBAC21	57.2	10.8	574.5	548.8	70.5	1,262	1.78	7.3	60.9	116	60.3	148	170	547	5,605
BBAD21	57.3	10.7	573.6	551.2	69.9	1,263	1.75	7.2	60.9	116	60.1	148	170	532	5,635
BBAE21	57.4	10.5	570.7	554.6	68.7	1,262	1.73	7.0	60.9	116	62.3	145	170	530	5,695
BBBB21	57.4	10.6	570.8	549.4	68.4	1,257	1.81	7.1	61.8	116	61.1	147	169	542	5,674
BBBC21	57.4	10.7	571.7	551.9	68.0	1,260	1.78	7.1	62.1	116	62.4	150	170	581	5,716
BBBD21	57.1	10.5	569.9	554.2	66.9	1,259	1.75	6.9	62.3	117	63.4	148	169	646	5,755
BBBE21	57.7	8.4	572.4	556.4	67.3	1,262	1.83	7.2	61.5	116	59.5	145	169	623	5,624
BBCC21	57.3	9.1	570.8	546.7	68.9	1,253	1.84	7.2	62.5	117	62.0	149	167	552	5,650
BBCD21	57.1	9.2	572.0	549.8	70.5	1,259	1.78	7.2	62.4	117	61.0	148	168	614	5,710
BBCE21	57.4	7.8	568.2	556.9	69.1	1,259	1.79	7.0	62.4	117	61.1	146	168	604	5,705
BBDD21	57.7	7.8	570.5	547.7	67.9	1,252	1.85	7.2	63.0	117	60.5	148	167	606	5,675
BBDE21	57.4	6.7	565.3	557.3	66.6	1,253	1.79	6.8	63.2	118	63.7	141	165	681	5,773
BCAA21	57.1	10.6	570.3	546.3	68.7	1,253	1.82	7.1	61.9	117	63.4	147	168	601	5,736
BCAB21	57.1	10.4	568.9	549.4	68.1	1,254	1.78	6.9	62.1	117	64.8	147	168	580	5,771
BCAC21	57.2	10.3	567.3	551.8	66.3	1,253	1.75	6.7	62.3	117	67.1	147	166	607	5,794
BCAD21	57.1	9.6	570.1	551.5	66.5	1,255	1.77	6.9	61.8	117	62.4	148	167	633	5,703
BCAE21	57.5	8.2	569.1	555.7	67.8	1,258	1.80	6.9	61.4	116	60.4	145	168	510	5,672
BCBB21	57.2	10.2	571.5	548.6	69.7	1,257	1.80	7.1	62.7	117	63.9	148	168	572	5,766
BCBC21	57.1	9.1	572.9	548.5	68.8	1,256	1.81	7.1	62.5	117	60.9	149	168	593	5,700
BCBD21	57.2	9.0	569.8	553.3	68.6	1,258	1.78	7.0	62.6	117	63.0	147	167	596	5,742
BCBE21	57.1	7.7	565.7	560.2	67.3	1,258	1.77	6.8	62.6	117	61.9	146	167	481	5,738
BCCC21	57.3	7.8	573.6	544.5	68.0	1,251	1.89	7.4	63.0	118	60.3	146	169	603	5,608
BCCD21	57.5	7.7	568.9	551.2	66.4	1,252	1.84	7.0	63.3	118	60.6	147	167	561	5,692
BCCE21	58.2	5.6	572.4	559.5	72.3	1,268	1.81	7.1	62.8	118	58.1	139	170	574	5,685
BCDD21	57.3	7.0	565.3	550.4	67.3	1,247	1.81	6.9	64.4	118	62.7	149	166	594	5,786
BCDE21	58.5	5.1	567.8	560.5	69.0	1,261	1.80	7.0	64.2	119	57.1	138	167	564	5,747
BDAA21	57.3	10.0	572.7	539.3	70.1	1,249	1.78	7.2	60.9	121	64.6	145	168	533	5,767
BDAB21	57.2	8.5	569.8	542.0	68.7	1,246	1.84	7.1	61.1	117	63.5	150	166	595	5,738
BDAC21	57.3	8.8	569.2	544.1	67.6	1,247	1.78	6.9	61.2	117	63.4	149	167	568	5,781
BDAD21	57.5	7.8	573.7	545.4	68.1	1,252	1.85	7.3	60.7	118	59.9	148	168	587	5,630
BDAE21	57.2	6.9	568.2	554.5	69.5	1,256	1.79	6.9	60.8	117	62.3	147	167	600	5,760
BDBB21	57.3	8.3	574.8	539.6	70.0	1,250	1.87	7.4	61.6	118	60.6	147	169	644	5,724
BDBC21	57.5	7.7	570.9	543.8	67.2	1,247	1.89	7.2	61.7	118	61.6	147	167	597	5,658
BDBD21	57.5	7.0	573.8	548.1	70.0	1,256	1.86	7.4	61.7	118	59.5	147	169	580	5,677

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BDBE21	57.7	6.1	570.4	558.8	71.3	1,264	1.78	7.0	61.7	120	59.7	141	167	554	5,772
BDCC21	57.7	6.9	570.2	541.6	68.8	1,245	1.88	7.2	62.5	118	60.7	147	167	617	5,733
BDCD21	57.3	6.8	564.2	549.7	66.7	1,245	1.81	6.8	63.0	118	63.0	150	165	556	5,824
BDCE21	58.7	5.1	569.7	559.2	72.4	1,265	1.82	7.1	62.3	119	55.0	142	169	510	5,729
BDDD21	57.7	6.0	567.4	546.4	70.3	1,248	1.80	7.1	63.5	121	61.5	142	165	526	5,826
BBAE31	55.7	10.0	567.9	554.7	69.8	1,258	1.73	7.3	62.2	111	66.5	157	169	424	5,676
BBAE32	54.7	9.1	568.7	554.0	70.9	1,257	1.78	7.2	63.2	109	66.3	159	168	569	5,716
BBAE33	54.7	8.5	562.6	553.8	69.4	1,249	1.77	6.8	63.6	106	67.5	164	168	528	5,869
BBAE41	55.2	9.2	569.3	554.3	71.2	1,259	1.76	7.4	62.8	109	64.6	157	168	459	5,690
BBAE42	54.5	8.7	566.7	554.0	70.0	1,254	1.74	6.9	63.6	105	66.2	162	167	545	5,788
BBAE43	54.4	8.3	560.5	553.5	69.1	1,246	1.75	6.6	64.2	102	67.3	174	168	522	5,951
BBAE51	53.6	9.0	568.7	554.3	69.2	1,255	1.76	7.2	63.2	108	62.5	157	168	482	5,710
BBAE52	53.2	8.6	563.9	554.3	68.8	1,249	1.74	6.7	63.8	105	64.1	160	167	541	5,853
BBAE53	53.4	8.0	560.2	554.0	66.7	1,242	1.75	6.5	64.2	102	66.1	169	165	571	5,987
BBAE61	54.8	6.6	569.6	540.7	66.9	1,239	1.85	8.2	63.6	106	60.1	164	168	445	5,557
BBAE62	53.5	5.7	567.2	538.6	70.1	1,235	1.87	7.9	64.7	105	62.4	168	166	507	5,740
BBAE63	51.0	5.2	566.8	537.2	69.1	1,229	1.87	7.6	64.8	97	62.9	180	165	533	5,794
BBAE71	55.2	9.3	569.3	554.9	70.3	1,259	1.74	7.2	63.7	108	66.2	156	170	428	5,634
BBAE72	54.2	8.6	566.5	554.6	69.9	1,254	1.74	7.1	64.7	105	68.2	160	169	563	5,726
BBAE73	52.9	7.3	564.2	553.9	70.1	1,248	1.77	6.9	64.8	100	68.1	171	166	567	5,827
BBAE81	53.0	6.6	569.7	538.9	66.9	1,235	1.85	8.2	63.8	106	59.6	162	168	486	5,565
BBAE82	52.3	5.6	565.9	538.8	69.9	1,233	1.86	7.8	64.9	105	62.0	163	167	527	5,778
BBAE83	52.7	5.6	556.6	538.0	63.8	1,217	1.87	7.1	65.0	101	62.2	171	164	585	5,920
BBAE91	53.2	9.0	569.5	554.8	70.3	1,257	1.73	7.2	63.9	107	65.1	156	170	473	5,650
BBAE92	52.3	8.2	566.0	554.3	69.6	1,250	1.74	7.0	64.7	104	68.4	156	168	550	5,739
BBAE93	51.7	7.3	562.7	553.8	69.7	1,245	1.76	6.8	64.8	101	67.5	168	166	575	5,862
CAAA21	57.2	11.6	580.5	478.3	74.5	1,202	1.80	8.0	59.7	116	59.7	149	174	529	5,507
CAAB21	56.9	11.7	579.8	472.5	74.3	1,195	1.77	7.8	59.5	115	60.6	150	174	550	5,549
CAAC21	56.9	11.7	579.1	473.6	73.0	1,194	1.76	7.7	59.7	115	60.4	152	174	575	5,575
CAAD21	57.0	11.6	578.2	474.8	73.8	1,195	1.75	7.7	59.7	115	59.6	150	174	542	5,588
CAAE21	57.1	10.8	578.8	482.7	72.3	1,202	1.75	7.7	59.6	116	58.1	147	174	536	5,563
CABB21	56.6	10.0	581.7	476.7	74.5	1,199	1.79	8.2	60.4	115	57.4	149	176	603	5,416
CABC21	56.8	9.8	581.3	479.7	72.5	1,200	1.77	8.0	60.6	117	57.4	148	175	601	5,479
CABD21	56.9	10.3	581.0	480.6	73.4	1,202	1.79	8.0	60.4	116	57.9	149	174	545	5,517
CABE21	57.1	9.5	579.6	485.3	73.1	1,205	1.78	7.8	60.6	117	57.1	144	174	554	5,553
CACC21	57.2	10.1	577.6	479.6	71.6	1,196	1.81	7.8	61.1	117	58.5	148	173	555	5,596
CACD21	57.1	9.5	579.4	481.1	71.9	1,199	1.81	7.8	61.1	116	56.3	148	174	593	5,546
CACE21	57.3	7.6	576.4	488.0	71.5	1,201	1.82	7.7	61.2	117	57.5	144	172	519	5,590
CADD21	57.1	8.8	577.3	475.8	73.0	1,192	1.81	7.8	61.6	117	57.3	148	173	581	5,608
CADE21	57.4	6.5	577.3	490.3	71.0	1,203	1.83	7.7	61.7	117	56.2	142	171	620	5,575
CBAA21	57.2	11.1	579.4	542.3	71.9	1,262	1.79	7.7	60.8	117	59.5	149	173	526	5,591
CBAB21	56.8	9.8	580.9	541.3	72.3	1,261	1.79	7.8	60.5	117	57.6	148	174	607	5,491
CBAC21	57.1	10.0	579.6	544.8	71.5	1,263	1.77	7.7	60.7	117	57.5	150	173	554	5,541

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CBAD21	57.2	10.2	579.6	548.6	72.5	1,268	1.77	7.7	60.6	116	58.9	150	173	515	5,572
CBAE21	57.2	9.4	577.4	553.6	72.4	1,270	1.76	7.4	60.8	116	58.3	144	172	525	5,612
CBBB21	57.2	10.2	578.0	544.4	71.8	1,262	1.84	7.8	61.4	117	58.4	148	173	544	5,595
CBBC21	57.4	10.8	577.6	548.1	71.5	1,265	1.80	7.6	61.9	117	59.3	150	172	546	5,631
CBBD21	57.3	9.4	578.6	549.3	70.9	1,266	1.81	7.7	61.5	117	57.4	151	173	587	5,591
CBBE21	57.5	7.3	579.4	555.5	72.9	1,273	1.84	7.8	61.2	117	55.3	144	174	585	5,558
CBCC21	57.1	8.2	579.7	544.4	71.6	1,261	1.87	8.0	62.4	117	57.4	150	173	546	5,567
CBCD21	57.2	8.7	577.2	548.3	71.8	1,263	1.81	7.6	62.3	117	58.0	147	171	586	5,643
CBCE21	57.5	6.5	579.1	556.1	70.5	1,270	1.83	7.8	61.9	117	55.5	143	173	509	5,554
CBDD21	56.5	6.5	581.2	544.1	75.3	1,264	1.84	8.5	62.9	116	54.7	145	175	604	5,450
CBDE21	58.1	5.3	576.2	556.6	72.3	1,268	1.84	7.7	63.2	119	54.3	139	171	575	5,581
CCAA21	57.3	10.8	578.2	539.2	72.5	1,258	1.87	7.9	61.3	117	59.4	146	172	501	5,542
CCAB21	57.1	10.6	576.6	544.1	71.6	1,260	1.82	7.6	61.5	117	60.6	148	170	491	5,632
CCAC21	57.1	10.4	575.2	547.5	70.2	1,260	1.78	7.4	61.8	117	62.0	146	169	522	5,705
CCAD21	57.2	9.3	575.2	548.6	69.9	1,260	1.78	7.3	61.5	117	59.7	147	171	545	5,661
CCAE21	57.6	7.2	578.1	554.2	72.7	1,270	1.82	7.7	60.8	117	57.3	142	172	515	5,598
CCBB21	57.1	10.3	579.2	545.3	73.3	1,265	1.87	7.9	62.3	117	58.4	147	172	531	5,580
CCBC21	57.3	8.0	578.1	547.4	71.0	1,262	1.87	7.9	62.3	117	58.8	146	172	559	5,619
CCBD21	57.1	8.6	576.0	551.1	71.2	1,264	1.81	7.4	62.4	117	60.2	146	169	600	5,696
CCBE21	57.6	6.4	579.1	558.6	73.0	1,275	1.81	7.7	61.7	118	55.3	140	173	497	5,603
CCCC21	56.9	7.1	578.7	541.2	69.8	1,254	1.91	7.9	62.7	117	57.0	147	174	633	5,550
CCCD21	56.8	7.5	582.7	547.4	75.2	1,270	1.81	8.3	62.7	118	55.7	143	176	566	5,488
CCCE21	58.2	5.3	578.6	559.3	74.0	1,275	1.84	7.8	62.8	118	53.6	140	172	590	5,566
CCDD21	57.6	6.0	581.3	544.3	73.1	1,262	1.89	8.2	63.7	117	52.9	145	173	621	5,511
CDAA21	57.2	10.1	579.0	533.4	73.8	1,253	1.89	8.0	60.6	117	59.6	146	172	569	5,569
CDAB21	57.2	9.9	576.7	539.6	72.5	1,256	1.84	7.7	60.9	117	60.1	147	170	560	5,672
CDAC21	57.3	8.4	577.3	540.4	70.5	1,254	1.83	7.5	60.7	117	59.7	147	170	630	5,680
CDAD21	56.9	7.3	579.0	542.6	71.1	1,257	1.87	7.8	60.4	117	57.0	148	174	622	5,559
CDAE21	57.5	6.3	577.8	552.8	73.7	1,268	1.79	7.6	60.0	119	54.6	141	174	432	5,642
CDBB21	57.4	7.5	578.2	537.9	71.9	1,253	1.92	7.9	61.3	117	58.9	149	171	551	5,580
CDBC21	57.1	7.2	577.3	540.4	69.4	1,251	1.91	7.8	61.3	118	57.9	147	173	623	5,593
CDBD21	57.2	6.5	579.9	547.1	74.6	1,265	1.85	8.1	61.5	119	54.9	142	175	527	5,603
CDBE21	58.4	5.3	579.0	558.0	74.1	1,275	1.85	7.9	61.1	119	50.3	141	175	540	5,575
CDCC21	57.4	6.5	578.2	538.9	73.4	1,254	1.87	8.0	62.2	120	56.0	142	173	541	5,642
CDCD21	57.2	5.9	581.3	543.3	73.9	1,262	1.90	8.3	62.2	119	52.6	144	174	637	5,525
CDDD21	57.5	5.6	579.0	542.8	75.8	1,261	1.88	8.2	63.3	120	52.1	142	171	555	5,599
CBAE31	55.8	9.0	573.5	553.9	72.3	1,264	1.75	7.8	61.9	111	61.7	156	172	319	5,581
CBAE32	54.5	8.6	571.7	553.5	70.3	1,259	1.75	7.5	63.0	109	63.4	161	171	471	5,670
CBAE33	53.4	6.8	570.1	552.7	70.7	1,254	1.80	7.5	63.4	102	62.6	169	171	504	5,677
CBAE41	55.1	8.7	572.6	553.8	70.9	1,261	1.74	7.7	62.6	107	61.9	159	171	424	5,641
CBAE42	54.2	8.3	570.6	553.6	71.2	1,258	1.72	7.3	63.4	105	62.4	162	171	489	5,728
CBAE43	53.9	7.3	568.8	553.0	72.1	1,255	1.75	7.3	63.8	101	64.1	176	170	470	5,836
CBAE51	53.2	8.4	573.0	553.8	71.7	1,260	1.73	7.6	63.0	106	59.7	161	170	433	5,641
CBAE52	51.7	6.8	573.4	553.0	71.7	1,257	1.79	7.6	63.5	101	61.2	166	170	495	5,681

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CBAE53	51.0	6.3	569.7	552.7	71.0	1,251	1.80	7.4	63.8	98	63.0	176	168	527	5,830
CBAE61	54.3	6.2	575.0	539.1	72.3	1,247	1.86	8.9	63.2	105	57.5	165	172	419	5,481
CBAE62	52.1	5.8	577.0	538.7	74.3	1,248	1.81	9.1	64.4	106	55.2	166	175	431	5,562
CBAE63	50.6	5.4	572.4	537.7	72.7	1,239	1.80	8.3	65.0	101	56.4	174	172	421	5,781
CBAE71	54.3	8.1	575.7	554.3	72.8	1,265	1.75	7.8	63.4	106	61.3	156	173	315	5,524
CBAE72	52.3	7.3	572.7	554.0	72.4	1,259	1.75	7.7	64.5	101	64.0	162	172	499	5,614
CBAE73	51.1	6.7	566.8	553.4	71.1	1,249	1.74	7.2	65.0	97	65.2	174	169	526	5,794
CBAE81	52.4	6.2	575.3	538.3	72.1	1,244	1.86	8.8	63.5	106	56.4	163	172	458	5,477
CBAE82	50.7	5.8	576.3	538.7	75.1	1,246	1.80	8.9	64.7	107	55.4	162	173	440	5,600
CBAE83	50.0	5.4	570.5	537.7	73.4	1,237	1.79	8.2	65.0	101	56.5	169	171	450	5,824
CBAE91	52.0	7.7	575.4	554.2	72.9	1,262	1.74	7.9	63.6	105	60.9	158	173	410	5,533
CBAE92	50.9	7.2	571.6	553.9	72.2	1,256	1.75	7.6	64.7	101	64.3	159	170	475	5,638
CBAE93	49.8	6.0	569.2	552.7	71.7	1,249	1.79	7.5	64.5	97	62.6	172	170	555	5,694
DAAA21	56.3	11.4	588.6	473.8	77.7	1,208	1.84	8.7	59.0	115	57.4	149	178	635	5,190
DAAB21	56.5	11.3	588.0	476.3	77.1	1,209	1.83	8.5	59.2	116	56.3	148	179	612	5,280
DAAC21	56.1	10.3	587.5	474.9	75.4	1,204	1.82	8.6	59.1	113	55.6	152	179	652	5,236
DAAD21	56.5	11.4	588.1	478.3	77.5	1,212	1.81	8.8	59.2	114	56.1	152	178	566	5,169
DAAE21	56.5	10.7	586.8	482.8	76.1	1,213	1.78	8.3	59.2	116	55.0	145	178	588	5,359
DABB21	56.3	11.3	588.3	474.4	76.6	1,207	1.88	8.9	60.1	115	56.9	151	179	556	5,161
DABC21	56.8	11.1	586.4	478.2	76.0	1,209	1.84	8.6	60.3	115	55.7	149	178	560	5,263
DABD21	56.3	9.3	588.7	481.7	75.4	1,211	1.78	8.6	60.0	116	57.1	150	176	586	5,241
DABE21	55.8	7.2	586.7	485.1	75.6	1,210	1.84	8.6	59.7	112	53.2	149	178	656	5,208
DACC21	56.0	8.2	589.8	472.8	77.2	1,204	1.94	9.4	60.4	112	50.9	152	180	610	4,963
DACD21	56.0	8.2	589.8	472.8	77.2	1,204	1.94	9.4	60.4	112	50.9	152	180	610	4,963
DACE21	56.4	6.0	588.3	488.2	77.9	1,217	1.91	9.0	60.2	114	49.5	141	178	737	5,070
DADD21	56.6	6.8	590.2	479.3	77.1	1,210	1.94	9.4	61.2	115	50.8	146	180	768	4,980
DBAA21	56.0	8.6	592.2	527.8	77.9	1,262	2.06	9.7	59.5	114	52.3	149	182	689	4,834
DBAB21	56.4	8.5	592.1	534.8	78.7	1,271	1.94	9.5	59.5	114	52.2	150	181	641	4,919
DBAC21	56.3	8.7	591.1	540.6	77.6	1,274	1.90	9.4	59.8	112	52.8	154	181	584	4,955
DBAD21	56.2	8.2	591.3	544.1	77.8	1,278	1.89	9.3	60.0	112	51.1	152	180	590	4,958
DBAE21	55.9	7.1	587.5	552.6	75.3	1,279	1.83	8.5	59.7	112	54.3	150	178	607	5,252
DBBB21	56.4	8.7	590.0	538.3	77.1	1,270	1.94	9.3	60.7	113	52.3	153	179	596	5,012
DBBC21	56.3	8.2	590.8	540.8	77.6	1,274	1.94	9.3	61.0	113	50.9	151	180	609	4,985
DBBD21	56.2	7.5	588.4	546.4	76.6	1,275	1.91	9.0	61.0	111	52.4	153	179	610	5,121
DBBE21	56.5	6.0	590.4	563.6	78.4	1,295	1.93	9.2	60.4	114	47.7	143	181	709	5,007
DBCC21	56.1	7.5	587.3	539.9	76.2	1,267	1.93	8.9	61.9	112	53.2	151	178	625	5,228
DBCD21	56.8	6.8	592.1	542.5	77.4	1,276	1.95	9.5	61.2	114	50.1	148	180	744	4,931
DBDD21	56.4	6.0	590.0	541.6	77.8	1,272	1.95	9.5	62.3	115	47.6	145	180	735	4,971
DCAA21	56.1	8.7	591.2	529.0	77.8	1,263	1.99	9.4	60.0	114	53.2	146	180	693	4,956
DCAB21	56.3	8.7	589.6	537.2	76.9	1,269	1.91	9.0	60.4	113	53.4	151	178	641	5,080
DCAC21	56.2	8.1	591.0	539.7	77.1	1,272	1.90	9.1	60.5	113	52.4	149	178	669	5,050
DCAD21	55.8	7.5	588.4	545.0	76.3	1,273	1.88	8.8	60.6	112	53.7	150	178	659	5,201
DCAE21	56.1	6.0	591.1	554.0	78.2	1,285	1.91	9.1	59.7	113	47.8	142	181	722	5,009

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DCBB21	56.0	8.5	587.4	537.3	77.0	1,266	1.91	9.1	61.0	114	54.4	145	179	629	5,110
DCBC21	55.8	7.3	586.1	542.4	76.3	1,268	1.90	8.9	61.5	114	54.3	146	178	635	5,217
DCBD21	56.3	8.0	585.9	549.0	76.2	1,275	1.82	8.4	61.6	115	54.5	150	176	616	5,395
DCBE21	56.6	5.8	589.3	559.3	78.0	1,289	1.88	8.9	61.2	114	48.7	145	178	635	5,119
DCCC21	56.6	6.7	591.8	535.9	77.0	1,268	1.97	9.5	61.8	114	50.8	149	179	796	4,991
DCCD21	56.2	6.0	592.4	544.1	78.0	1,277	1.96	9.5	61.9	114	47.9	145	180	743	4,921
DCDD21	56.6	5.8	589.4	542.4	78.0	1,272	1.93	9.5	63.5	115	47.5	145	179	722	4,994
DDAA21	55.9	8.4	587.7	522.3	77.3	1,252	2.00	9.4	59.4	115	52.4	144	179	666	5,004
DDAB21	55.4	6.8	593.8	526.1	77.5	1,260	2.06	9.9	59.5	112	49.2	149	183	742	4,734
DDAC21	56.0	6.7	591.9	534.6	77.0	1,266	1.97	9.4	59.8	112	51.6	149	180	711	4,939
DDAD21	56.5	6.3	590.6	540.8	77.0	1,271	1.93	9.2	59.8	113	51.3	150	179	681	5,068
DDAE21	56.8	5.8	590.2	553.1	78.8	1,285	1.86	9.0	59.2	114	47.6	146	180	588	5,099
DDBB21	56.3	6.7	587.9	530.8	76.2	1,258	1.99	9.0	60.5	114	53.1	145	178	705	5,207
DDBC21	56.4	6.3	590.4	536.6	76.6	1,266	1.98	9.3	60.9	113	51.2	149	179	762	5,088
DDBD21	56.8	6.4	593.3	543.0	78.4	1,278	1.93	9.5	60.6	116	48.3	145	180	719	4,946
DDCC21	56.2	5.9	592.8	532.0	77.7	1,265	2.01	9.7	61.2	115	48.4	145	179	747	4,928
DDCD21	56.6	5.8	590.6	541.3	78.5	1,273	1.94	9.7	61.9	115	45.5	146	182	670	4,905
DBAE31	54.4	6.8	582.5	552.6	76.8	1,273	1.82	9.0	61.0	111	55.8	157	177	309	5,250
DBAE32	52.5	6.4	580.9	552.1	76.3	1,268	1.82	8.7	62.2	107	57.6	162	177	439	5,345
DBAE33	52.6	5.8	582.1	552.4	77.1	1,270	1.86	9.1	62.2	102	58.6	170	176	480	5,219
DBAE41	53.3	6.6	581.7	552.5	76.6	1,271	1.81	8.9	61.6	107	56.2	159	177	355	5,309
DBAE42	52.7	6.0	584.9	552.7	77.6	1,274	1.85	9.3	62.1	102	56.3	167	177	448	5,104
DBAE43	51.6	5.7	579.9	552.1	77.0	1,266	1.84	8.9	62.4	97	57.0	180	174	509	5,311
DBAE51	51.6	6.3	582.6	552.5	76.4	1,269	1.81	8.9	62.2	105	53.0	161	177	376	5,285
DBAE52	50.3	5.5	583.4	553.2	77.2	1,270	1.84	9.3	62.8	102	52.9	164	179	375	5,117
DBAE53	49.9	5.4	582.1	552.3	76.7	1,266	1.84	9.0	62.7	97	56.2	179	173	525	5,292
DBAE61	53.4	5.6	589.2	540.8	77.9	1,267	1.90	10.7	62.3	104	53.6	166	180	419	4,876
DBAE62	50.9	5.1	584.9	539.1	77.1	1,257	1.90	10.1	63.5	101	56.0	173	177	506	5,106
DBAE63	49.7	4.7	578.6	538.1	76.1	1,247	1.88	9.2	64.1	95	55.3	182	174	505	5,440
DBAE71	53.4	6.1	585.6	553.3	77.5	1,276	1.83	9.2	62.3	104	53.9	158	180	294	5,105
DBAE72	51.4	5.6	581.7	552.8	77.0	1,268	1.83	8.9	63.4	101	57.5	164	177	431	5,254
DBAE73	49.8	5.1	581.5	552.5	77.1	1,266	1.86	9.0	63.7	95	57.7	177	175	526	5,166
DBAE81	51.5	5.5	589.3	540.0	77.7	1,264	1.90	10.6	62.7	105	52.7	164	180	448	4,889
DBAE82	49.8	5.1	584.2	538.9	77.0	1,255	1.89	10.0	63.7	102	55.9	170	176	523	5,141
DBAE83	48.6	4.7	576.3	538.5	75.8	1,244	1.85	9.3	64.5	99	52.4	172	176	490	5,450
DBAE91	51.2	5.9	585.1	553.2	77.5	1,273	1.82	9.2	62.6	105	53.6	157	179	324	5,122
DBAE92	49.8	5.6	581.0	552.8	76.9	1,266	1.83	8.9	63.7	101	57.5	160	176	439	5,287
DBAE93	48.4	5.1	580.7	552.4	76.8	1,263	1.85	9.0	63.7	96	57.8	175	174	526	5,207
EAAA21	55.7	8.1	597.6	462.9	78.8	1,203	2.29	11.0	58.1	107	48.9	155	187	636	4,385
EAAB21	55.8	8.0	596.7	472.1	79.0	1,212	2.17	10.8	58.2	107	48.7	155	186	605	4,440
EAAC21	55.3	8.1	595.5	470.7	78.6	1,208	2.12	10.7	58.4	110	49.3	153	185	631	4,500
EAAD21	55.3	6.9	595.5	488.3	78.4	1,224	2.09	10.6	58.8	111	48.3	153	185	618	4,532
EAAE21	55.7	6.9	592.2	485.4	77.7	1,218	1.93	9.7	58.6	111	49.5	147	184	641	4,819

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EABB21	55.2	7.4	595.8	465.7	78.9	1,203	2.19	10.8	59.1	110	48.9	153	185	648	4,512
EABC21	55.1	6.9	595.3	484.3	77.8	1,219	2.16	10.7	59.8	112	47.5	153	185	637	4,565
EABD21	55.5	7.2	595.3	486.6	78.1	1,223	2.02	10.4	59.5	112	47.0	150	186	623	4,572
EABE21	56.5	6.5	594.4	488.3	78.9	1,225	1.92	9.9	59.1	113	45.9	145	183	687	4,738
EACC21	55.2	6.9	593.1	472.2	77.6	1,205	2.08	10.3	60.2	111	46.7	150	185	683	4,682
EACD21	56.4	9.1	594.5	478.3	77.9	1,216	1.94	9.8	60.6	113	49.2	150	184	649	4,778
EADD21	56.3	6.1	592.6	479.6	78.4	1,213	1.99	10.1	61.1	114	46.9	142	183	670	4,780
EBAA21	55.8	8.0	596.8	517.0	79.2	1,257	2.22	10.8	58.9	110	48.4	152	186	695	4,458
EBAB21	55.4	7.4	596.7	529.7	78.7	1,268	2.15	10.7	59.2	111	49.0	153	185	663	4,509
EBAC21	55.6	7.1	596.8	532.9	78.6	1,271	2.07	10.8	59.3	110	46.2	155	186	629	4,432
EBAD21	55.5	6.9	594.4	542.6	77.6	1,277	2.02	10.2	59.7	112	47.5	150	185	650	4,630
EBAE21	56.6	6.5	595.9	552.6	79.4	1,291	1.90	9.9	58.9	113	46.0	144	183	623	4,712
EBBB21	55.7	7.1	596.3	528.1	78.5	1,266	2.14	11.0	60.0	110	45.8	152	187	656	4,446
EBBC21	55.7	7.2	596.0	535.5	78.0	1,272	2.04	10.6	60.4	112	45.7	151	186	658	4,576
EBBD21	56.5	6.8	595.1	546.2	77.8	1,282	1.98	10.0	61.0	112	48.2	151	184	654	4,725
EBCC21	55.5	6.8	594.1	534.3	78.7	1,269	2.11	10.8	60.8	114	45.0	145	185	718	4,599
EBCD21	56.5	6.1	595.1	543.0	78.5	1,279	2.02	10.2	61.1	114	46.6	143	183	706	4,702
ECAA21	55.2	7.5	596.2	513.3	79.5	1,252	2.14	11.0	59.2	109	47.0	152	188	704	4,420
ECAB21	55.7	7.0	596.0	525.2	78.6	1,263	2.11	10.9	59.5	110	46.3	152	187	664	4,460
ECAC21	55.8	7.2	595.7	534.0	78.2	1,271	2.01	10.5	60.0	112	46.9	150	186	644	4,597
ECAD21	55.7	6.7	595.7	540.6	79.1	1,278	2.07	10.7	59.5	111	45.8	150	184	693	4,554
ECBB21	55.8	7.1	595.3	529.6	78.3	1,266	2.07	10.6	60.7	112	46.1	148	186	658	4,606
ECBC21	55.7	6.7	595.1	535.6	79.2	1,272	2.12	10.8	60.5	111	45.5	149	185	716	4,556
ECBD21	56.6	6.1	596.1	545.4	79.1	1,283	2.03	10.3	60.9	115	46.3	145	183	689	4,650
ECCC21	56.8	6.6	594.5	533.3	79.2	1,270	2.01	10.5	61.6	114	45.5	146	185	661	4,629
ECCD21	56.5	6.3	594.4	542.5	79.2	1,279	2.02	10.6	61.7	113	45.4	147	185	724	4,583
EDAA21	55.7	7.2	595.8	511.2	80.4	1,250	2.14	11.1	58.2	112	45.4	149	188	796	4,335
EDAB21	55.6	6.9	596.7	520.6	79.9	1,260	2.12	11.1	58.3	113	45.2	151	187	722	4,382
EDAC21	55.8	6.8	594.5	529.4	79.3	1,266	2.08	10.6	58.6	110	45.0	157	186	648	4,562
EDBB21	55.8	6.8	594.0	524.1	79.4	1,260	2.16	10.7	59.4	110	44.5	157	186	713	4,551
EDBC21	56.3	6.2	594.0	534.1	78.9	1,269	2.05	10.3	60.6	114	45.9	146	185	699	4,698
EDBD21	56.3	6.2	596.1	541.1	79.4	1,279	2.05	10.7	60.2	111	44.8	151	185	674	4,496
EDCC21	56.3	6.2	595.4	530.3	79.1	1,267	2.08	10.8	60.8	112	45.2	151	185	683	4,516
EBAE31	54.7	6.1	590.1	552.6	78.8	1,282	1.89	10.5	60.3	110	48.7	157	184	374	4,753
EBAE32	52.4	5.8	589.8	552.2	78.4	1,279	1.90	10.2	61.8	103	51.8	164	183	507	4,754
EBAE33	51.9	5.2	589.2	552.4	79.1	1,278	1.98	10.6	62.1	103	53.6	167	184	484	4,715
EBAE41	53.6	6.0	589.2	552.5	78.7	1,280	1.88	10.3	61.0	105	49.5	159	183	410	4,807
EBAE42	51.8	5.7	588.3	552.3	78.5	1,277	1.87	10.1	62.1	101	51.8	163	182	476	4,813
EBAE43	50.9	5.2	588.8	552.1	79.1	1,276	1.96	10.5	62.3	98	51.2	173	182	507	4,783
EBAE51	52.0	5.3	591.4	553.2	78.8	1,281	1.94	10.4	61.6	104	50.9	160	182	423	4,757
EBAE52	49.8	5.0	588.3	553.0	78.3	1,274	1.91	10.1	62.3	100	52.5	162	181	464	4,867
EBAE53	49.6	4.9	587.0	553.0	78.4	1,273	1.94	10.2	62.4	98	52.2	176	181	518	4,880
EBAE61	52.6	5.1	591.2	541.9	79.1	1,270	1.95	11.2	62.7	104	50.0	165	186	354	4,727
EBAE62	51.2	4.7	588.7	539.8	78.4	1,263	1.93	11.0	63.7	105	49.9	163	188	448	4,815

Table A-2. Economic benefits and environmental resource values for 384 alternatives averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EBAE63	48.3	4.6	589.3	538.9	78.3	1,259	1.99	10.9	63.8	96	51.1	181	184	526	4,760
EBAE71	53.2	5.6	592.8	552.8	79.6	1,284	1.90	10.6	61.9	104	50.9	161	185	363	4,586
EBAE72	51.1	5.3	589.2	552.3	79.1	1,277	1.90	10.4	63.0	100	53.3	163	183	513	4,712
EBAE73	49.4	5.0	584.3	551.9	78.1	1,269	1.89	9.9	63.3	95	51.9	174	181	537	4,900
EBAE81	51.1	5.7	594.8	539.9	79.3	1,271	1.88	11.5	62.5	109	45.7	158	189	427	4,551
EBAE82	49.2	4.7	591.3	538.7	79.2	1,263	2.01	11.7	63.4	107	49.9	162	190	556	4,594
EBAE83	46.5	3.8	589.4	537.8	79.1	1,257	1.98	11.9	63.3	102	50.7	173	187	406	4,455
EBAE91	50.9	5.4	592.1	552.7	79.6	1,281	1.89	10.6	62.1	103	49.7	160	184	412	4,618
EBAE92	49.2	5.2	588.3	552.2	79.1	1,274	1.90	10.4	63.3	100	53.4	161	181	476	4,737
EBAE93	48.7	4.7	588.6	552.2	79.0	1,273	1.97	10.5	63.2	98	52.1	171	183	509	4,734
GAAA21	54.5	9.2	598.9	458.3	79.7	1,201	2.10	11.3	58.5	111	49.0	154	189	697	4,212
GAAB21	54.0	7.4	599.0	463.7	79.0	1,203	2.23	11.6	57.7	106	46.5	157	189	668	4,225
GAAC21	54.0	7.0	598.6	470.8	79.4	1,210	2.14	11.4	58.4	107	46.9	159	189	628	4,243
GAAD21	54.5	7.4	598.0	478.3	78.5	1,217	2.09	10.8	58.7	107	46.4	158	188	570	4,377
GAAE21	54.3	6.4	596.6	481.3	79.6	1,218	1.99	10.6	58.4	112	47.1	146	187	630	4,415
GABB21	54.9	7.0	597.8	461.7	80.5	1,202	2.23	11.8	58.6	108	45.7	153	191	652	4,069
GABC21	54.9	6.4	596.2	471.2	80.2	1,209	2.18	11.7	58.8	109	45.2	156	191	634	4,170
GABD21	55.0	6.4	595.5	476.9	80.0	1,214	2.08	11.3	59.5	109	45.0	158	189	608	4,266
GACC21	55.0	6.5	595.2	470.1	79.8	1,207	2.12	11.4	60.1	109	45.2	157	189	630	4,279
GACD21	55.4	6.6	594.9	473.1	79.6	1,210	2.06	10.9	60.1	108	46.1	159	187	633	4,411
GBAA21	54.1	7.2	598.3	513.3	79.9	1,253	2.33	11.8	58.3	109	46.4	155	190	769	4,160
GBAB21	54.1	7.4	598.5	524.7	80.7	1,265	2.19	11.9	58.9	108	44.9	154	191	620	4,066
GBAC21	54.1	6.8	597.6	529.8	80.5	1,269	2.16	11.7	59.1	109	45.0	157	191	615	4,166
GBAD21	54.1	6.8	596.9	539.7	80.3	1,278	2.06	11.3	59.6	109	45.9	158	189	593	4,254
GBBB21	55.0	6.4	597.6	523.7	80.5	1,263	2.23	11.7	59.7	109	45.1	155	190	641	4,150
GBBC21	54.2	6.8	596.8	533.4	80.0	1,271	2.12	11.4	60.6	109	44.3	157	190	632	4,252
GBBD21	54.9	6.9	597.2	542.7	79.9	1,282	2.01	10.8	60.8	112	44.9	154	188	681	4,358
GBCC21	55.6	6.5	595.8	533.9	79.6	1,271	2.10	10.9	61.1	109	45.3	159	187	655	4,404
GCAA21	55.2	6.9	598.5	516.0	80.8	1,257	2.23	11.8	59.1	109	45.5	155	191	689	4,073
GCAB21	55.1	6.4	597.6	521.9	80.5	1,261	2.20	11.7	59.1	109	44.7	156	191	641	4,142
GCAC21	55.9	6.4	596.8	532.0	80.3	1,271	2.09	11.3	59.9	112	45.8	153	191	608	4,259
GCAD21	55.1	6.4	596.3	541.2	79.9	1,279	2.04	10.9	60.0	109	45.9	159	187	573	4,352
GCBB21	55.9	6.4	596.8	526.5	80.2	1,266	2.17	11.4	60.7	112	45.3	151	191	635	4,253
GDAA21	55.6	6.9	596.8	510.0	80.7	1,250	2.21	11.7	58.2	109	45.6	157	191	708	4,105
EVQ2	0.0	-2.9	567.7	490.3	80.5	1,136	1.89	11.6	61.7	81	63.4	185	168	2308	4,367
POWER3	47.6	5.0	602.1	536.1	75.2	1,266	1.96	9.8	62.0	96	72.4	145	177	832	3,985

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ABAA10	99.4	100.0	96.3	99.4	93.2	98.7	87.9	75.1	83.3	100.0	79.3	83.0	93.2	29.8	98.9
ABAA20	98.9	95.4	97.1	99.7	96.6	99.4	88.8	82.1	84.3	98.7	75.8	83.7	96.5	26.7	91.1
ABAA11	98.7	99.9	96.1	99.4	92.8	98.6	90.0	76.0	84.0	97.3	81.7	82.7	91.7	37.4	99.3
AAAA21	98.1	96.8	97.5	94.6	96.8	97.5	91.8	83.7	84.5	94.5	76.2	84.8	95.5	37.9	91.0
AAAB21	98.1	96.8	97.5	94.6	96.8	97.5	91.8	83.7	84.5	94.5	76.2	84.8	95.5	37.9	91.0
AAAC21	98.1	96.8	97.5	94.6	96.8	97.5	91.8	83.7	84.5	94.5	76.2	84.8	95.5	37.9	91.0
AAAD21	98.1	96.8	97.5	94.6	96.8	97.5	91.8	83.7	84.5	94.5	76.2	84.8	95.5	37.9	91.0
AAAE21	98.1	96.8	97.5	94.6	96.8	97.5	91.8	83.7	84.5	94.5	76.2	84.8	95.5	37.9	91.0
AABB21	98.3	96.2	97.3	94.8	96.3	97.4	91.5	83.1	84.9	94.8	77.2	84.5	95.1	38.7	91.5
AABC21	98.3	96.2	97.3	94.8	96.3	97.4	91.5	83.1	84.9	94.8	77.2	84.5	95.1	38.7	91.5
AABD21	98.3	96.2	97.3	94.8	96.3	97.4	91.5	83.1	84.9	94.8	77.2	84.5	95.1	38.7	91.5
AABE21	98.3	96.2	97.3	94.8	96.3	97.4	91.4	83.1	84.9	94.8	77.3	84.5	95.1	38.7	91.5
AACC21	98.3	95.6	97.1	94.8	95.4	97.2	91.2	82.5	85.2	95.0	79.2	84.4	94.6	38.6	92.0
AACD21	98.3	95.6	97.1	94.8	95.4	97.2	91.2	82.5	85.2	95.0	79.2	84.4	94.6	38.6	92.0
AACE21	98.3	95.6	97.1	94.8	95.4	97.2	91.2	82.5	85.2	95.0	79.2	84.4	94.6	38.6	92.0
AADD21	98.3	94.0	97.1	94.9	95.7	97.3	91.2	82.5	85.2	95.1	77.9	85.6	94.6	39.5	92.2
AADE21	98.2	92.8	97.0	95.0	96.0	97.3	91.2	82.2	85.2	95.1	78.7	84.2	94.5	39.6	92.3
AAEE21	99.1	86.3	96.8	95.2	94.2	97.1	90.3	80.8	84.3	96.2	80.1	82.8	93.4	39.4	93.9
ABAA21	98.1	95.1	97.2	99.7	95.5	99.3	90.7	82.1	85.4	95.1	78.6	84.1	94.6	38.6	92.1
ABAB21	98.1	95.1	97.2	99.7	95.5	99.3	90.7	82.1	85.4	95.1	78.6	84.1	94.6	38.6	92.1
ABAC21	98.1	95.1	97.2	99.7	95.5	99.3	90.7	82.1	85.4	95.1	78.6	84.1	94.6	38.6	92.1
ABAD21	98.1	95.1	97.2	99.7	95.5	99.3	90.7	82.1	85.4	95.1	78.6	84.1	94.6	38.6	92.1
ABAE21	98.1	95.1	97.2	99.7	95.5	99.3	90.7	82.1	85.4	95.1	78.6	84.1	94.6	38.6	92.1
ABBB21	98.5	94.4	97.1	99.5	94.9	99.1	90.9	82.0	85.7	95.2	79.1	84.2	94.2	38.7	92.3
ABBC21	98.5	94.2	97.1	99.6	94.8	99.2	90.7	81.9	85.7	95.2	79.2	84.7	94.3	38.6	92.4
ABBD21	98.5	94.1	97.0	99.6	94.7	99.2	90.6	81.9	85.8	95.2	79.2	85.0	94.2	39.0	92.4
ABBE21	98.5	94.2	97.0	99.7	95.1	99.2	90.5	81.7	85.8	95.2	80.0	83.8	94.1	38.9	92.5
ABCC21	98.2	93.2	97.1	99.5	94.9	99.1	90.7	81.8	86.1	95.3	78.5	85.1	94.4	39.3	92.5
ABCD21	98.2	93.4	97.0	99.5	95.2	99.1	90.7	81.6	86.1	95.3	79.2	85.2	94.3	39.1	92.5
ABCE21	98.1	92.4	96.9	99.7	95.0	99.1	90.8	81.6	86.1	95.3	79.1	83.4	94.2	38.3	92.6
ABDD21	98.8	91.5	96.9	99.4	95.1	99.0	91.1	81.6	86.2	95.4	78.4	85.6	94.0	39.3	93.0
ABDE21	98.8	90.9	96.8	99.7	94.7	99.1	90.7	81.1	86.2	95.6	79.7	83.7	93.7	39.4	93.2
ACAA21	98.7	93.3	97.0	99.6	94.7	99.1	90.3	81.0	85.9	95.5	79.8	83.8	93.9	37.8	93.1
ACAB21	98.7	93.3	97.0	99.7	94.6	99.1	90.0	80.9	86.0	95.6	80.3	84.0	93.7	37.8	93.2
ACAC21	98.6	93.0	97.0	99.6	94.9	99.2	90.6	81.3	85.9	95.4	79.0	85.2	94.1	38.1	92.8
ACAD21	98.7	93.1	97.1	99.7	95.5	99.2	90.2	81.3	85.8	95.3	79.0	85.1	94.3	38.2	92.9
ACAE21	98.7	92.7	96.9	99.8	95.6	99.2	90.0	80.9	85.9	95.5	79.7	83.7	94.1	38.0	93.1
ACBB21	98.7	92.8	96.9	99.6	94.5	99.1	90.5	80.9	86.2	95.5	79.7	84.4	93.8	38.4	93.2
ACBC21	98.7	92.4	96.9	99.7	94.8	99.1	90.3	80.7	86.3	95.5	80.0	85.1	93.9	38.4	93.4
ACBD21	99.0	92.6	96.9	99.8	94.8	99.2	90.2	80.7	86.4	95.7	80.6	84.9	93.7	38.0	93.5
ACBE21	99.0	91.2	96.9	99.9	95.5	99.2	90.5	80.9	86.2	95.4	78.9	84.1	94.1	36.5	93.2
ACCC21	98.8	91.4	96.9	99.7	93.5	99.0	90.6	80.7	86.6	95.5	80.4	85.2	93.8	38.5	93.9

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ACCD21	98.7	91.6	96.8	99.8	93.5	99.0	90.2	80.4	86.6	95.7	80.9	85.4	93.7	37.2	94.0
ACCE21	99.0	89.7	96.9	100.0	95.0	99.2	90.6	80.7	86.5	95.7	79.4	83.6	93.7	38.1	93.8
ACDD21	99.1	89.7	96.7	99.7	93.0	98.9	90.7	80.3	86.8	95.6	80.2	85.4	93.4	38.2	94.5
ACDE21	99.1	88.5	96.6	100.0	94.5	99.0	90.0	79.7	86.9	96.2	81.0	84.0	93.2	37.6	94.9
ADAA21	99.0	91.8	97.0	99.4	93.8	98.9	90.4	80.4	85.2	95.8	80.9	84.7	93.7	38.6	94.3
ADAB21	99.1	91.7	96.9	99.5	93.5	99.0	90.1	80.0	85.3	95.9	81.0	85.3	93.6	38.9	94.4
ADAC21	99.1	91.1	97.0	99.4	93.9	99.0	90.4	80.6	85.1	95.7	80.1	86.1	93.7	39.7	94.0
ADAD21	99.1	90.8	96.9	99.6	93.5	99.0	90.0	80.3	85.2	95.6	79.9	85.4	94.0	37.9	94.1
ADAE21	99.4	89.6	96.9	99.7	95.2	99.1	90.3	80.3	85.1	95.5	79.3	84.3	93.9	38.5	94.0
ADBB21	99.1	90.4	96.9	99.5	93.3	98.9	90.6	80.0	85.6	95.9	81.6	84.9	93.2	40.2	94.7
ADBC21	99.1	90.2	96.8	99.6	92.9	98.9	90.2	79.6	85.7	95.9	81.8	85.2	93.3	39.5	94.9
ADBD21	99.2	89.6	97.0	99.6	94.1	99.1	90.8	80.3	85.5	95.8	79.2	85.6	93.7	38.3	94.3
ADBE21	99.4	88.8	96.8	99.9	93.6	99.1	90.1	79.8	85.5	95.9	80.3	84.1	93.5	39.0	94.6
ADCC21	98.9	88.8	96.8	99.4	93.6	98.8	90.3	79.7	85.8	96.1	80.7	85.6	93.3	37.9	95.1
ADCD21	99.1	89.0	96.8	99.6	93.9	99.0	89.8	79.4	85.9	96.2	81.6	85.1	93.0	40.1	95.4
ADCE21	99.2	87.6	96.6	99.9	92.9	98.9	89.5	78.8	85.9	96.7	81.4	83.0	92.8	36.9	95.7
ADDD21	99.3	87.6	96.7	99.6	93.5	98.8	89.9	79.1	86.1	96.8	81.4	83.9	92.8	38.9	95.9
ADDE21	100.0	82.9	96.6	99.9	94.4	99.0	89.3	78.8	86.2	97.0	79.4	82.6	93.0	35.7	96.2
ABAE31	97.3	92.6	96.8	99.6	95.8	99.1	91.0	82.0	87.2	93.3	87.0	87.9	93.4	36.9	93.1
ABAE32	95.7	89.8	96.3	99.5	95.4	98.7	90.3	79.3	89.1	90.1	93.6	90.0	92.6	39.8	95.8
ABAE33	94.0	86.4	95.6	99.5	95.0	98.1	90.1	76.5	90.7	85.5	98.5	93.9	91.2	42.8	98.3
ABAE41	95.6	91.2	96.6	99.6	96.0	98.9	89.6	81.3	88.2	90.5	87.0	88.6	92.5	36.5	94.0
ABAE42	94.2	88.0	96.1	99.5	95.4	98.5	89.1	77.7	89.9	87.5	93.8	90.6	92.0	38.9	97.0
ABAE43	92.5	84.4	95.5	99.5	94.9	98.0	89.3	75.2	91.2	83.6	100.0	97.7	90.8	43.1	99.4
ABAE51	88.9	84.2	96.6	99.6	95.4	98.5	87.9	80.2	89.0	89.7	85.8	89.3	92.4	36.0	94.6
ABAE52	88.0	81.0	96.3	99.5	95.6	98.2	88.3	77.7	90.6	87.0	92.4	90.7	91.9	36.5	97.2
ABAE53	87.0	78.3	95.6	99.4	95.1	97.8	88.7	74.8	91.9	83.7	97.4	95.3	91.0	40.3	100.0
ABAE61	95.8	73.5	97.0	98.0	94.3	98.1	92.6	89.0	89.6	90.3	84.7	90.0	92.9	38.7	92.7
ABAE62	94.1	69.1	96.3	97.7	93.5	97.4	92.6	84.7	91.6	86.9	93.5	94.0	91.5	39.4	96.3
ABAE63	92.0	66.2	95.8	97.5	93.4	97.0	91.3	81.3	92.8	84.1	98.7	97.6	90.6	43.9	99.3
ABAE71	95.4	80.9	96.9	99.6	96.0	98.9	90.6	82.2	90.3	89.5	86.6	88.6	93.3	34.9	92.0
ABAE72	93.5	79.1	96.2	99.5	95.6	98.4	90.6	78.6	92.5	86.1	95.9	91.0	92.2	39.3	95.1
ABAE73	91.7	75.3	95.6	99.5	95.0	97.9	90.5	75.3	93.9	81.9	99.9	96.3	91.3	43.1	97.9
ABAE81	89.5	71.3	97.0	97.9	94.4	97.8	91.1	88.0	90.2	89.2	83.2	89.4	92.8	38.5	93.3
ABAE82	88.5	67.5	96.3	97.7	93.6	97.2	91.4	83.9	92.2	86.7	92.9	92.3	91.6	39.7	96.7
ABAE83	87.3	64.7	95.7	97.5	93.4	96.7	90.4	80.3	93.1	84.4	99.2	95.4	90.4	44.4	99.9
ABAE91	88.1	80.7	96.9	99.6	96.2	98.6	88.8	81.4	91.2	88.7	86.2	89.0	93.0	35.7	92.5
ABAE92	87.7	77.7	96.2	99.5	95.8	98.2	89.4	77.7	93.3	85.7	96.6	89.7	92.0	36.7	95.6
ABAE93	86.2	73.9	95.5	99.5	95.0	97.7	89.4	74.2	94.5	82.2	99.7	95.1	91.3	42.7	98.5
BAAA21	97.8	96.6	97.5	94.7	96.9	97.5	91.3	83.8	84.4	94.5	76.7	84.6	95.6	38.6	90.8
BAAB21	97.8	96.6	97.5	94.7	96.9	97.5	91.3	83.8	84.4	94.5	76.7	84.6	95.6	38.6	90.8

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BAAC21	97.8	96.6	97.5	94.7	96.9	97.5	91.3	83.8	84.4	94.5	76.7	84.6	95.6	38.6	90.8
BAAD21	97.8	96.6	97.5	94.7	96.9	97.5	91.3	83.8	84.4	94.5	76.7	84.6	95.6	38.6	90.8
BAAE21	97.8	96.6	97.5	94.7	96.9	97.5	91.3	83.8	84.4	94.5	76.7	84.6	95.6	38.6	90.9
BABB21	97.9	96.0	97.6	94.7	96.4	97.5	91.4	83.8	84.8	94.6	76.5	84.9	95.5	37.7	90.9
BABC21	97.9	95.9	97.6	94.7	96.3	97.5	91.3	83.7	84.8	94.6	76.6	85.6	95.5	37.6	91.0
BABD21	97.9	95.9	97.5	94.8	96.6	97.5	91.2	83.7	84.8	94.8	77.0	85.6	95.5	38.5	91.1
BABE21	97.9	95.2	97.5	94.8	97.0	97.5	91.3	83.7	84.8	94.6	76.6	84.4	95.4	37.9	90.9
BACC21	97.9	95.1	97.5	94.8	96.3	97.5	91.7	83.7	85.0	94.6	76.8	86.2	95.2	39.5	91.1
BACD21	98.0	94.9	97.5	94.8	96.2	97.5	91.5	83.5	85.1	94.7	76.7	86.3	95.3	38.8	91.2
BACE21	97.9	93.9	97.5	95.0	96.6	97.5	91.4	83.5	85.1	94.9	76.5	84.6	95.3	39.7	91.3
BADD21	98.0	93.4	97.4	94.9	95.9	97.4	91.3	83.2	85.2	95.0	76.8	86.2	95.1	39.3	91.8
BADE21	98.0	91.0	97.4	95.1	96.2	97.5	91.5	83.2	85.1	95.0	77.2	84.6	94.8	39.9	91.6
BBAA21	98.0	95.2	97.6	99.4	96.5	99.4	91.0	83.3	85.2	95.0	77.4	84.9	95.2	38.0	91.5
BBAB21	97.8	94.9	97.6	99.3	96.7	99.4	91.6	83.7	85.1	94.7	76.0	85.0	95.4	37.3	91.0
BBAC21	97.9	94.8	97.6	99.4	96.6	99.4	91.3	83.5	85.2	94.7	76.4	85.7	95.3	37.2	91.2
BBAD21	98.0	94.7	97.6	99.5	96.5	99.5	91.0	83.3	85.2	94.8	76.3	85.6	95.3	37.0	91.3
BBAE21	98.0	94.4	97.5	99.6	96.2	99.4	90.8	83.0	85.2	95.0	77.1	84.3	95.3	36.9	91.6
BBBB21	98.0	94.3	97.5	99.4	96.1	99.3	91.4	83.1	85.6	94.9	76.7	84.6	95.1	36.9	91.6
BBBC21	98.1	94.4	97.5	99.5	96.0	99.4	91.1	83.1	85.7	95.2	77.2	85.7	95.2	37.8	91.8
BBBD21	97.8	94.2	97.4	99.6	95.7	99.4	90.8	82.8	85.8	95.2	77.6	85.5	95.1	39.0	92.0
BBBE21	98.2	91.6	97.5	99.7	95.8	99.4	91.6	83.2	85.5	94.8	76.2	84.0	95.1	38.5	91.4
BBCC21	97.9	92.2	97.4	99.3	96.1	99.3	91.5	83.0	85.9	95.1	77.5	85.4	94.7	38.1	91.7
BBCD21	97.8	92.3	97.5	99.4	96.5	99.4	90.9	82.9	85.9	95.4	77.1	85.3	94.8	39.3	92.0
BBCE21	97.9	90.6	97.4	99.7	96.2	99.4	91.0	82.6	85.9	95.4	77.1	84.1	94.7	39.2	92.0
BBDD21	98.6	90.4	97.4	99.3	95.8	99.2	91.4	82.6	86.0	95.2	77.1	85.1	94.6	38.7	92.2
BBDE21	98.4	89.0	97.2	99.7	95.4	99.3	90.8	82.0	86.0	95.7	78.2	83.4	94.4	39.8	92.7
BCAA21	98.2	93.7	97.4	99.4	96.0	99.3	91.0	82.4	85.7	95.4	78.4	84.6	94.7	38.8	92.3
BCAB21	98.2	93.6	97.4	99.5	95.9	99.3	90.6	82.2	85.7	95.4	78.9	84.8	94.6	38.7	92.5
BCAC21	98.3	93.4	97.3	99.6	95.4	99.3	90.3	81.8	85.8	95.4	79.7	85.3	94.4	38.9	92.6
BCAD21	98.2	92.6	97.4	99.6	95.4	99.3	90.6	82.1	85.6	95.4	78.1	85.5	94.6	39.5	92.2
BCAE21	98.5	90.8	97.4	99.7	95.7	99.4	90.8	82.1	85.5	95.1	77.4	84.1	94.6	36.8	92.0
BCBB21	98.2	93.2	97.4	99.5	96.2	99.4	90.7	82.2	86.1	95.5	78.5	85.1	94.6	38.4	92.7
BCBC21	98.2	91.7	97.5	99.5	96.0	99.4	90.8	82.2	86.0	95.3	77.5	85.4	94.6	38.7	92.4
BCBD21	98.3	91.7	97.4	99.7	96.0	99.4	90.5	81.9	86.1	95.5	78.2	85.3	94.4	38.7	92.6
BCBE21	98.2	90.0	97.2	99.9	95.6	99.4	90.5	81.7	86.1	95.5	77.8	84.4	94.5	36.3	92.6
BCCC21	98.3	90.1	97.5	99.3	95.7	99.2	91.5	82.5	86.2	95.3	77.4	85.1	94.7	38.6	92.4
BCCD21	98.5	89.8	97.3	99.6	95.3	99.3	91.0	81.9	86.3	95.3	77.5	85.3	94.4	37.8	92.8
BCCE21	99.0	86.1	97.4	99.9	96.8	99.5	90.8	82.1	86.2	95.4	76.3	83.3	94.8	38.0	92.5
BCDD21	98.3	88.8	97.2	99.5	95.5	99.2	90.6	81.3	86.7	95.6	79.0	85.7	94.2	38.3	93.8
BCDE21	99.3	85.2	97.3	99.9	95.8	99.4	90.3	81.5	86.7	95.9	77.1	83.1	94.3	38.1	93.5
BDAA21	98.2	92.4	97.5	99.1	96.3	99.2	89.4	81.7	84.8	97.3	80.2	84.8	94.5	34.9	93.3
BDAB21	98.4	90.5	97.3	99.2	95.8	99.1	90.9	81.7	84.9	95.7	79.0	85.4	94.0	39.1	93.2

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BDAC21	98.4	90.9	97.3	99.3	95.5	99.2	90.3	81.5	85.0	95.6	79.0	85.2	94.1	38.1	93.4
BDAD21	98.6	89.6	97.5	99.3	95.7	99.3	91.0	82.0	84.8	95.5	77.8	84.9	94.3	39.2	92.7
BDAE21	98.4	88.5	97.3	99.7	96.1	99.3	90.4	81.3	84.9	95.6	78.6	84.5	94.1	39.2	93.3
BDBB21	98.5	90.0	97.5	99.1	96.2	99.2	91.0	81.9	85.3	95.5	78.2	84.6	94.3	39.9	93.6
BDBC21	98.7	89.2	97.4	99.3	95.5	99.2	91.2	81.6	85.3	95.6	78.6	85.0	94.1	39.2	93.3
BDBD21	98.7	88.4	97.5	99.5	96.2	99.3	90.9	81.9	85.3	95.6	77.8	85.1	94.3	38.9	93.4
BDBE21	98.8	86.5	97.3	99.9	96.3	99.4	90.2	81.5	85.2	96.1	77.5	83.5	94.1	38.5	93.5
BDCC21	98.8	87.9	97.3	99.2	95.7	99.1	90.9	81.3	85.7	95.7	78.3	84.9	93.9	39.7	94.2
BDCD21	98.5	87.9	97.1	99.5	95.1	99.1	90.1	80.6	85.8	95.9	79.1	86.0	93.7	38.8	94.6
BDCE21	99.5	83.5	97.3	99.9	96.7	99.4	90.4	81.3	85.6	96.2	76.7	83.7	94.1	38.1	93.8
BDDD21	98.9	86.2	97.2	99.4	95.9	99.1	89.6	80.6	85.9	96.8	78.9	84.2	93.6	37.0	95.4
BBAE31	96.5	91.7	97.1	99.6	96.4	99.2	91.2	83.1	87.0	93.0	85.3	87.7	93.9	36.2	92.4
BBAE32	95.5	88.0	96.7	99.5	96.5	98.9	91.1	81.0	88.9	89.9	91.1	89.7	93.2	39.4	94.8
BBAE33	93.8	84.3	96.0	99.4	96.0	98.4	90.6	77.7	90.5	85.5	95.1	93.5	92.0	42.0	97.7
BBAE41	95.4	89.7	97.0	99.6	97.0	99.1	90.2	82.8	88.1	89.9	84.7	89.0	92.9	35.7	93.1
BBAE42	93.9	85.7	96.5	99.5	96.3	98.7	89.7	79.1	89.9	86.8	91.0	91.2	92.6	38.7	96.1
BBAE43	92.6	82.4	95.9	99.4	95.8	98.2	90.0	76.6	91.3	82.9	97.1	97.6	91.6	42.7	98.7
BBAE51	88.5	82.5	97.1	99.6	96.6	98.8	88.5	81.7	89.0	88.8	83.5	89.3	92.7	35.5	93.8
BBAE52	87.8	80.0	96.5	99.5	96.1	98.4	88.6	78.4	90.6	86.4	90.9	90.8	92.5	36.6	96.7
BBAE53	86.7	77.2	95.8	99.4	95.3	97.9	88.9	75.4	91.9	83.5	95.5	95.7	91.8	40.9	99.6
BBAE61	95.5	73.2	97.3	98.0	95.3	98.3	92.3	89.8	89.4	89.3	84.3	90.7	93.1	38.6	92.2
BBAE62	93.6	68.4	96.6	97.7	95.7	97.7	92.4	85.9	91.5	86.5	93.2	93.8	91.7	38.7	96.0
BBAE63	90.4	64.9	96.3	97.5	95.4	97.3	92.3	83.2	92.6	81.8	97.8	99.0	91.0	44.4	98.2
BBAE71	95.3	82.5	97.2	99.6	96.5	99.1	90.7	83.1	90.2	88.7	85.6	89.1	93.7	34.3	91.3
BBAE72	94.1	78.6	96.5	99.5	96.1	98.6	90.8	79.9	92.4	85.7	94.8	90.8	92.7	38.0	94.5
BBAE73	91.4	73.8	96.0	99.4	96.0	98.1	90.9	76.8	93.7	81.6	97.2	96.2	91.9	42.1	97.2
BBAE81	88.6	70.8	97.2	97.9	95.5	97.9	90.9	89.2	90.2	88.7	83.3	90.7	93.0	38.1	92.9
BBAE82	88.0	67.0	96.6	97.7	95.9	97.5	91.1	85.1	92.1	86.4	92.5	91.7	91.9	38.9	96.5
BBAE83	87.6	63.3	95.8	97.5	94.1	96.9	91.6	81.7	93.1	82.9	96.3	95.9	91.4	44.3	99.4
BBAE91	87.8	80.6	97.2	99.6	96.9	98.8	88.9	82.5	91.0	87.8	84.8	89.6	93.4	34.7	91.9
BBAE92	86.8	76.4	96.5	99.5	96.2	98.3	89.6	78.8	93.1	85.3	95.8	89.6	92.4	36.6	95.1
BBAE93	85.9	72.2	95.9	99.4	95.9	97.9	90.1	75.8	94.3	81.6	97.2	94.8	91.6	42.4	97.9
CAAA21	97.9	96.6	97.8	94.4	97.8	97.5	92.4	85.4	84.4	94.5	76.0	85.0	95.8	38.1	89.9
CAAB21	97.6	96.8	97.8	94.2	97.8	97.5	92.2	85.0	84.3	94.4	76.3	85.4	95.7	39.0	90.1
CAAC21	97.6	96.8	97.7	94.2	97.4	97.4	92.0	85.0	84.4	94.4	76.2	86.3	95.7	39.4	90.3
CAAD21	97.7	96.7	97.7	94.3	97.7	97.5	91.9	84.9	84.4	94.4	76.0	86.1	95.8	38.9	90.3
CAAE21	97.8	95.8	97.7	94.5	97.2	97.5	91.9	84.9	84.4	94.5	75.5	84.8	95.8	38.8	90.2
CABB21	97.7	94.7	97.8	94.4	97.8	97.5	92.2	85.7	84.8	94.4	75.4	85.3	96.0	39.5	89.7
CABC21	97.9	94.5	97.8	94.5	97.3	97.5	92.0	85.3	84.8	94.9	75.4	85.5	95.9	39.5	90.0
CABD21	98.0	95.1	97.8	94.6	97.5	97.6	92.2	85.3	84.7	94.7	75.5	85.4	95.8	38.6	90.2
CABE21	98.1	94.1	97.7	94.7	97.4	97.6	92.0	85.0	84.8	94.7	75.3	84.0	95.8	38.8	90.3

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CACC21	98.2	94.5	97.6	94.5	97.0	97.5	92.1	84.8	85.1	94.8	75.8	85.8	95.5	38.6	90.7
CACD21	98.1	93.8	97.7	94.6	97.1	97.5	92.1	85.0	85.1	94.7	75.0	85.8	95.7	39.1	90.5
CACE21	98.3	91.4	97.6	94.8	97.0	97.5	92.2	84.7	85.1	94.8	75.4	84.2	95.5	37.3	90.7
CADD21	98.1	92.7	97.6	94.5	97.4	97.4	91.9	84.7	85.1	94.7	75.4	85.5	95.4	39.1	91.1
CADE21	98.4	89.8	97.6	95.0	96.8	97.6	91.8	84.5	85.2	94.8	74.9	83.8	95.4	39.2	90.8
CBAA21	98.2	95.6	97.7	99.2	97.1	99.4	91.6	84.6	85.2	94.7	76.2	85.2	95.5	36.7	90.8
CBAB21	97.9	94.0	97.7	99.1	97.2	99.4	91.7	84.8	85.2	94.8	75.5	85.4	95.6	38.0	90.3
CBAC21	98.2	94.2	97.7	99.3	97.0	99.5	91.4	84.6	85.2	94.7	75.5	86.3	95.5	37.2	90.5
CBAD21	98.2	94.4	97.7	99.4	97.3	99.5	91.5	84.6	85.2	94.7	76.0	86.0	95.5	36.3	90.7
CBAE21	98.2	93.5	97.6	99.6	97.2	99.6	91.3	84.1	85.2	94.7	75.8	84.4	95.4	36.7	90.9
CBBB21	98.2	94.2	97.6	99.2	97.0	99.4	92.0	84.6	85.6	94.9	75.9	85.2	95.4	36.7	91.0
CBBC21	98.4	94.9	97.6	99.4	96.9	99.5	91.6	84.3	85.7	94.8	76.2	85.7	95.3	37.0	91.2
CBBD21	98.3	93.2	97.6	99.4	96.8	99.5	91.6	84.4	85.6	94.9	75.5	85.9	95.4	37.7	91.0
CBBE21	98.4	90.6	97.7	99.6	97.3	99.6	92.0	84.6	85.5	94.7	74.8	84.3	95.5	37.6	90.9
CBCC21	98.5	91.0	97.7	99.2	96.9	99.4	91.9	84.7	85.9	94.9	75.5	85.7	95.3	37.0	91.1
CBCD21	98.6	91.7	97.6	99.4	97.0	99.5	91.4	84.1	85.9	94.9	75.7	85.1	95.1	37.6	91.5
CBCE21	98.9	89.0	97.6	99.7	96.7	99.5	91.1	84.3	85.8	94.8	75.0	83.9	95.4	35.9	91.1
CBDD21	98.2	88.2	97.7	99.3	97.8	99.5	91.9	85.3	86.0	94.5	75.2	84.5	95.4	39.7	90.7
CBDE21	99.2	86.1	97.5	99.7	97.0	99.5	91.5	83.9	86.2	95.4	75.0	83.1	95.0	39.8	91.4
CCAA21	98.7	93.9	97.6	99.1	97.1	99.4	91.8	84.1	85.6	95.2	77.2	84.1	94.9	37.6	91.1
CCAB21	98.5	93.8	97.6	99.3	96.8	99.4	91.3	83.5	85.6	95.1	77.6	84.9	94.6	37.5	91.5
CCAC21	98.5	93.5	97.5	99.4	96.4	99.4	90.9	83.2	85.7	95.2	78.1	85.0	94.6	37.9	91.9
CCAD21	98.6	92.1	97.5	99.5	96.4	99.4	90.9	83.1	85.6	95.0	77.3	84.9	94.8	38.3	91.7
CCAE21	98.9	89.6	97.6	99.7	97.1	99.6	91.3	83.7	85.4	95.1	76.5	83.7	94.9	37.8	91.4
CCBB21	98.6	93.3	97.6	99.4	97.2	99.5	91.7	83.9	86.1	95.1	76.9	84.3	94.8	38.2	91.6
CCBC21	98.7	90.5	97.6	99.4	96.6	99.4	91.7	83.8	86.1	95.2	77.1	85.0	94.8	38.6	91.8
CCBD21	98.6	91.2	97.5	99.6	96.7	99.5	91.1	83.1	86.1	95.2	77.6	84.8	94.5	39.2	92.2
CCBE21	98.9	87.9	97.6	99.9	97.2	99.6	91.2	83.7	85.9	95.4	75.8	83.5	95.0	37.3	91.5
CCCC21	98.4	89.3	97.6	99.2	96.2	99.3	91.9	83.6	86.3	95.1	76.5	85.0	95.0	39.7	91.9
CCCD21	98.4	89.1	97.8	99.6	97.6	99.6	91.2	84.5	86.3	95.0	75.8	84.5	95.3	38.1	91.3
CCCE21	99.4	85.7	97.6	99.9	97.3	99.6	91.1	83.4	86.3	95.4	75.2	83.4	94.9	38.9	91.9
CCDD21	99.0	86.9	97.7	99.3	96.9	99.4	91.4	84.1	86.5	95.1	75.3	84.9	94.9	39.4	92.0
CDAA21	98.8	92.5	97.6	98.9	97.3	99.3	91.5	83.4	84.8	95.4	77.6	84.0	94.7	39.9	92.0
CDAB21	98.8	92.3	97.6	99.1	97.0	99.3	91.0	83.0	84.9	95.6	77.8	84.6	94.5	39.8	92.5
CDAC21	98.8	90.5	97.6	99.2	96.4	99.3	90.9	82.8	84.8	95.3	77.6	85.1	94.5	40.8	92.6
CDAD21	98.6	89.1	97.6	99.3	96.6	99.4	91.3	83.3	84.7	95.1	76.7	85.2	94.9	40.7	92.0
CDAE21	99.0	87.2	97.6	99.6	97.3	99.5	90.6	83.1	84.5	95.6	75.6	83.6	95.0	37.1	92.1
CDBB21	98.9	89.2	97.6	99.2	96.9	99.3	91.5	83.1	85.2	95.1	77.6	84.7	94.6	38.8	92.6
CDBC21	98.7	88.7	97.6	99.2	96.1	99.3	91.5	82.9	85.2	95.3	77.1	85.0	94.8	40.0	92.7
CDBD21	98.9	87.4	97.7	99.6	97.4	99.5	91.1	83.7	85.2	95.6	75.8	84.4	95.0	38.3	92.3
CDBE21	99.7	85.1	97.6	99.9	97.3	99.6	90.8	83.3	85.1	95.6	74.3	83.5	95.0	38.5	92.4
CDCC21	99.1	87.6	97.5	99.2	96.7	99.3	90.4	82.8	85.6	95.9	77.2	84.6	94.6	37.4	93.7

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CDCD21	98.9	85.3	97.7	99.3	97.0	99.3	92.0	83.8	85.5	95.6	75.7	84.5	94.8	40.9	92.2
CDDD21	99.3	84.3	97.5	99.3	97.3	99.3	91.5	83.2	85.9	96.4	75.4	84.0	94.3	39.7	93.4
CBAE31	97.0	90.3	97.3	99.6	97.1	99.3	91.2	83.9	86.8	93.0	83.3	87.7	94.3	34.5	92.0
CBAE32	95.4	87.4	96.8	99.5	96.3	98.9	90.8	81.5	89.0	89.7	90.3	90.8	93.6	37.8	94.5
CBAE33	93.2	82.0	96.3	99.5	96.3	98.5	91.0	79.0	90.6	84.1	93.3	94.9	92.3	41.8	96.6
CBAE41	95.3	89.2	97.2	99.6	96.9	99.2	90.0	83.4	88.1	89.3	83.8	89.2	93.3	35.0	92.7
CBAE42	93.6	85.4	96.7	99.5	96.6	98.8	89.4	79.8	89.9	86.4	89.9	91.2	93.0	37.7	95.5
CBAE43	92.2	81.3	96.3	99.5	96.7	98.5	89.9	78.1	91.3	82.8	95.1	98.0	92.1	41.7	97.8
CBAE51	88.3	81.8	97.2	99.6	97.3	98.9	88.4	82.5	88.9	88.2	82.6	90.0	93.1	35.1	93.3
CBAE52	86.6	77.9	96.8	99.5	96.8	98.5	89.0	80.0	90.6	85.4	90.5	91.2	92.8	36.2	95.6
CBAE53	85.1	75.6	96.2	99.5	96.4	98.1	89.4	77.2	92.1	81.7	95.3	97.0	91.9	40.5	98.5
CBAE61	95.1	72.7	97.5	98.0	96.8	98.4	92.4	90.9	89.3	89.1	83.5	90.9	93.5	38.4	91.9
CBAE62	92.6	68.0	96.9	97.8	96.7	97.9	92.0	88.2	91.4	86.7	90.1	94.3	92.8	36.8	95.0
CBAE63	90.0	64.9	96.5	97.6	96.4	97.5	91.2	84.4	92.7	82.7	95.2	98.6	92.0	41.4	98.4
CBAE71	94.5	81.3	97.4	99.7	97.3	99.2	90.7	84.3	90.1	88.2	83.8	88.2	94.0	32.9	90.7
CBAE72	92.7	77.0	96.7	99.6	96.8	98.7	90.8	81.0	92.3	84.8	93.2	90.8	93.0	36.8	93.9
CBAE73	90.1	73.2	96.1	99.4	96.2	98.1	90.6	77.2	93.6	80.7	96.5	96.7	92.2	41.6	97.0
CBAE81	88.2	70.3	97.4	97.9	96.9	98.1	91.0	90.2	90.1	88.3	82.1	91.1	93.4	37.7	92.4
CBAE82	86.8	66.6	96.9	97.8	97.3	97.7	90.6	87.4	91.9	86.8	88.1	92.8	93.0	37.6	95.4
CBAE83	85.7	63.4	96.3	97.6	96.7	97.3	90.5	83.6	93.1	82.9	95.5	95.9	91.7	41.9	98.9
CBAE91	86.8	79.1	97.4	99.7	97.5	98.9	89.0	83.5	90.9	87.1	83.4	89.1	93.8	34.2	91.3
CBAE92	85.8	75.2	96.6	99.6	96.9	98.4	89.7	79.8	93.0	84.3	94.2	90.0	92.6	35.4	94.6
CBAE93	84.5	70.8	96.2	99.5	96.4	98.0	90.3	76.9	94.1	80.7	95.2	95.5	92.2	42.1	96.9
DAAA21	97.1	96.3	98.1	94.4	98.7	97.7	92.5	86.6	84.3	94.2	75.3	84.5	96.2	39.2	88.2
DAAB21	97.2	96.1	98.1	94.4	98.6	97.7	92.4	86.3	84.3	94.3	75.0	84.7	96.3	38.9	88.6
DAAC21	96.9	94.9	98.1	94.4	98.1	97.7	92.4	86.5	84.3	93.7	74.7	86.0	96.3	39.5	88.4
DAAD21	97.2	96.2	98.1	94.6	98.7	97.8	92.3	86.7	84.3	93.7	74.9	85.9	96.2	38.2	88.1
DAAE21	97.2	95.4	98.0	94.7	98.3	97.8	91.9	85.9	84.3	94.4	74.5	84.0	96.3	38.5	89.0
DABB21	97.1	95.8	98.0	94.4	98.4	97.7	92.8	86.8	84.7	94.1	75.2	85.2	96.2	37.9	88.3
DABC21	97.5	95.7	98.0	94.6	98.2	97.7	92.4	86.3	84.8	94.3	74.7	85.5	96.2	38.0	88.8
DABD21	96.9	93.0	98.3	95.1	98.0	98.0	90.2	85.9	84.5	95.7	76.8	85.3	96.7	35.3	88.2
DABE21	96.7	90.8	98.0	94.9	98.1	97.8	92.3	86.3	84.7	93.3	73.7	84.4	96.3	39.6	88.5
DACC21	96.9	91.6	98.1	94.5	98.6	97.7	92.7	87.4	84.9	93.4	72.7	85.7	96.4	38.4	87.6
DACD21	96.9	91.7	98.1	94.5	98.6	97.7	92.9	87.5	84.9	93.4	73.4	85.7	96.4	38.4	87.5
DACE21	97.2	88.5	98.0	95.1	98.6	97.9	92.4	86.8	84.9	93.8	72.2	83.3	96.3	39.3	88.0
DADD21	97.4	89.6	98.1	94.8	98.5	97.8	92.6	87.4	85.1	93.9	72.9	85.3	96.4	40.4	87.9
DBAA21	97.0	92.0	98.1	98.8	98.8	99.5	93.8	87.9	85.0	93.7	73.4	85.1	96.6	37.8	87.0
DBAB21	97.3	92.0	98.1	99.1	99.0	99.7	92.6	87.6	85.0	93.7	73.3	85.5	96.5	37.1	87.4
DBAC21	97.2	92.2	98.1	99.3	98.7	99.7	92.2	87.4	85.0	93.3	73.5	86.3	96.5	35.9	87.6
DBAD21	97.1	91.5	98.1	99.4	98.7	99.8	92.0	87.2	85.1	93.4	72.9	86.1	96.4	36.3	87.6
DBAE21	96.9	90.2	98.0	99.7	98.1	99.8	91.5	86.0	85.0	93.3	74.0	84.9	96.2	36.5	88.9

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DBBB21	97.2	91.9	98.0	99.2	98.4	99.6	92.4	87.1	85.4	93.5	73.6	86.0	96.3	36.6	88.0
DBBC21	97.2	91.3	98.1	99.3	98.5	99.7	92.4	87.2	85.6	93.5	73.1	86.1	96.3	37.1	87.9
DBBD21	97.1	90.4	98.0	99.5	98.3	99.7	92.2	86.6	85.6	93.1	73.6	86.3	96.3	36.9	88.5
DBBE21	97.3	87.8	98.1	99.9	98.8	99.9	92.8	87.0	85.3	93.7	71.6	84.0	96.5	37.8	87.9
DBCC21	97.1	90.0	97.9	99.2	98.2	99.6	92.1	86.2	85.9	93.4	74.5	85.7	95.9	37.3	89.3
DBCD21	97.6	88.8	98.1	99.3	98.4	99.7	92.9	87.5	85.6	93.8	72.9	85.6	96.3	38.7	87.8
DBDD21	97.4	86.6	98.0	99.3	98.3	99.6	93.1	87.3	86.0	94.1	72.2	84.3	96.3	39.0	88.2
DCAA21	97.1	91.3	98.1	98.9	98.4	99.5	92.4	86.8	85.2	93.8	74.6	84.2	96.2	37.2	88.1
DCAB21	97.2	91.3	98.1	99.2	98.2	99.6	91.7	86.2	85.3	93.7	74.7	85.1	96.0	36.4	88.7
DCAC21	97.1	90.7	98.1	99.4	98.3	99.7	91.6	86.3	85.4	93.6	74.3	85.3	96.0	37.5	88.6
DCAD21	96.9	89.8	98.0	99.6	98.0	99.7	91.4	85.8	85.4	93.4	74.8	85.4	96.0	37.4	89.3
DCAE21	97.0	87.1	98.1	99.9	98.4	99.9	92.1	86.5	85.0	93.7	72.1	83.8	96.4	38.6	88.1
DCBB21	97.4	90.6	98.0	99.2	98.2	99.6	92.5	86.5	85.6	94.1	75.3	83.7	95.9	38.4	88.8
DCBC21	97.3	89.0	97.9	99.4	98.0	99.6	92.3	86.0	85.8	94.0	75.2	84.4	95.8	38.4	89.4
DCBD21	97.7	89.9	97.9	99.7	98.0	99.7	91.5	85.2	85.8	94.3	75.3	85.0	95.6	38.1	90.2
DCBE21	97.6	80.9	98.2	100.0	99.0	100.0	93.1	87.3	85.1	94.4	70.1	83.8	96.7	36.7	87.0
DCCC21	97.9	87.9	98.1	99.2	97.9	99.6	92.5	86.6	85.9	94.2	74.0	85.0	95.8	40.7	88.8
DCCD21	97.4	85.6	98.2	99.5	98.3	99.7	93.2	87.2	85.9	94.1	72.8	84.7	96.2	39.6	88.1
DCDD21	98.2	81.7	98.2	99.2	98.9	99.6	93.9	88.6	86.0	94.7	69.8	84.6	96.9	38.1	86.5
DDAA21	97.5	89.4	98.0	98.5	98.1	99.3	93.0	86.5	84.2	94.3	75.3	83.7	95.6	40.4	88.9
DDAB21	96.8	87.0	98.2	98.7	98.2	99.4	94.0	87.6	84.3	93.9	73.8	84.3	96.3	39.6	87.3
DDAC21	97.6	87.3	98.1	99.1	98.0	99.5	92.3	86.4	84.5	93.8	74.7	84.8	95.7	38.9	88.6
DDAD21	97.9	86.7	98.1	99.3	98.0	99.6	91.9	86.0	84.4	93.8	74.7	85.0	95.6	39.6	89.3
DDAE21	97.8	80.3	98.3	99.7	99.3	99.9	92.5	87.2	83.8	94.6	69.6	84.0	96.9	35.8	87.2
DDBB21	97.8	87.2	97.9	98.9	97.7	99.4	92.5	85.5	84.9	94.2	75.5	83.7	95.4	40.6	90.3
DDBC21	97.9	86.6	98.0	99.2	97.8	99.5	92.1	85.8	85.1	93.9	74.9	84.8	95.6	41.5	89.8
DDBD21	98.4	85.5	98.2	99.4	98.4	99.7	92.5	86.8	84.9	94.6	73.4	84.3	95.9	41.0	88.5
DDCC21	98.0	84.4	98.1	98.9	98.2	99.5	93.0	86.6	85.2	94.4	74.0	84.2	95.6	41.6	88.8
DDCD21	98.3	81.4	98.3	99.2	99.1	99.7	94.0	88.7	84.8	94.7	69.0	84.7	97.0	38.0	86.3
DBAE31	95.5	87.5	97.6	99.7	98.3	99.5	91.8	86.2	86.6	92.9	80.8	87.8	95.0	33.4	90.1
DBAE32	93.9	84.5	97.1	99.6	97.7	99.1	90.9	83.6	88.7	88.9	88.5	90.0	94.4	35.8	92.5
DBAE33	92.5	79.9	96.7	99.6	97.9	98.8	91.8	82.2	90.1	84.1	92.0	95.2	93.1	40.8	94.1
DBAE41	93.9	86.3	97.5	99.7	98.2	99.3	90.3	85.6	87.8	89.4	81.9	88.9	94.1	32.5	90.9
DBAE42	92.2	81.6	97.2	99.6	98.1	99.1	90.9	83.7	89.4	85.6	87.5	92.6	94.0	36.1	92.2
DBAE43	90.4	78.7	96.7	99.5	97.9	98.7	90.8	80.5	90.8	81.4	91.9	98.7	93.0	42.5	95.1
DBAE51	87.0	78.7	97.5	99.7	98.4	99.1	88.5	84.9	88.7	88.1	80.3	90.0	94.0	33.1	91.3
DBAE52	85.2	74.5	97.2	99.6	98.4	98.8	89.0	83.6	90.3	85.3	86.4	91.3	94.1	31.9	92.3
DBAE53	84.6	73.8	96.6	99.5	97.7	98.4	89.4	80.0	91.8	81.5	92.6	97.1	92.7	39.0	95.7
DBAE61	93.9	70.7	97.9	98.2	97.9	98.7	93.1	94.7	89.0	88.9	81.3	91.1	94.7	35.9	88.8
DBAE62	91.7	66.6	97.2	97.9	97.5	98.1	93.1	90.5	91.0	85.6	90.4	94.6	93.2	38.7	92.4
DBAE63	89.4	63.5	96.7	97.6	97.3	97.6	92.7	86.2	92.3	81.4	94.5	99.4	92.1	43.8	96.0
DBAE71	94.0	78.7	97.7	99.8	98.4	99.4	91.0	86.8	89.7	87.7	80.7	87.8	95.0	30.9	88.7

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DBAE72	91.4	74.4	97.0	99.6	97.9	98.8	91.6	83.5	91.8	84.8	90.7	90.3	93.7	35.3	92.0
DBAE73	89.1	70.5	96.6	99.6	97.6	98.5	92.0	80.7	93.1	80.3	93.5	97.0	93.0	41.2	93.9
DBAE81	86.8	67.8	97.9	98.1	98.3	98.4	91.5	94.1	89.9	88.1	79.7	90.8	94.6	36.3	88.8
DBAE82	86.1	65.6	97.2	97.9	97.5	97.9	91.2	89.3	91.7	85.6	90.3	93.9	93.0	37.3	93.2
DBAE83	84.4	61.7	96.5	97.7	97.1	97.3	90.2	85.8	93.1	82.8	92.3	96.4	92.5	40.1	96.6
DBAE91	85.9	76.0	97.7	99.7	98.5	99.1	89.7	86.1	90.6	87.1	79.9	88.1	94.7	31.9	89.2
DBAE92	86.3	72.3	97.0	99.6	98.0	98.6	90.3	82.4	92.5	84.5	90.9	89.2	93.5	34.4	92.6
DBAE93	83.2	69.0	96.5	99.6	97.7	98.2	90.8	79.6	93.8	80.6	94.3	95.9	92.7	40.8	94.6
EAAA21	96.3	89.9	98.5	93.9	98.9	97.6	97.4	91.2	83.8	91.7	71.4	85.6	97.9	36.5	83.5
EAAB21	96.5	89.8	98.5	94.4	98.9	97.8	96.5	91.0	83.9	91.7	71.9	86.2	97.6	36.8	83.7
EAAC21	96.7	90.4	98.4	94.4	98.9	97.8	95.4	90.4	84.1	92.6	72.1	86.2	97.5	37.1	84.2
EAAD21	96.5	90.1	98.4	95.0	98.8	98.0	94.9	90.2	84.3	93.2	71.9	86.2	97.5	37.1	84.4
EAAE21	96.5	90.0	98.3	94.9	98.8	97.9	93.6	88.7	84.2	93.0	72.3	84.2	97.4	38.6	85.8
EABB21	96.0	89.0	98.4	94.1	98.9	97.6	96.7	90.9	84.4	93.0	72.0	85.4	97.6	37.1	84.2
EABC21	96.6	89.8	98.3	94.9	98.6	97.9	95.4	90.2	84.8	93.2	71.6	85.9	97.5	37.1	84.7
EABD21	95.5	88.7	98.4	95.0	98.7	98.0	94.6	90.0	84.6	93.5	71.2	85.4	97.6	37.2	84.6
EABE21	97.6	89.3	98.3	95.0	99.0	98.0	92.9	89.0	84.6	93.5	70.9	84.1	97.3	38.2	85.5
EACC21	96.7	89.1	98.2	94.4	98.6	97.7	94.4	89.3	85.0	93.2	71.4	85.0	97.4	38.2	85.5
EACD21	96.9	90.5	98.3	94.7	98.6	97.9	93.6	89.0	85.1	93.5	72.4	85.4	97.3	37.3	85.8
EADD21	97.6	87.4	98.2	94.7	98.7	97.8	93.9	89.2	85.3	93.8	71.6	84.0	97.1	38.0	86.2
EBAA21	96.1	89.2	98.5	98.2	98.9	99.4	96.6	90.6	84.6	92.7	72.0	84.9	97.5	37.5	84.1
EBAB21	95.8	88.5	98.4	98.7	98.8	99.6	96.0	90.5	84.7	93.3	72.2	85.3	97.3	36.9	84.4
EBAC21	97.3	87.2	98.5	98.9	99.0	99.7	95.7	91.0	84.7	92.6	70.7	86.3	97.7	38.1	83.7
EBAD21	97.0	89.2	98.3	99.4	98.5	99.8	93.7	89.1	85.1	93.3	72.0	85.3	97.3	36.7	85.2
EBAE21	97.2	88.1	98.4	99.7	99.1	100.0	93.0	88.8	84.7	93.6	71.4	83.7	97.1	36.4	85.6
EBBB21	97.4	87.1	98.4	98.6	99.0	99.6	96.3	91.2	85.1	92.6	70.3	85.6	97.8	38.0	83.9
EBBC21	97.1	88.1	98.4	99.0	98.8	99.7	94.3	90.1	85.4	93.5	70.4	86.1	97.6	37.8	84.6
EBBD21	97.3	87.4	98.3	99.5	98.6	99.8	93.8	88.9	85.6	93.4	72.1	85.5	97.2	36.5	85.7
EBCC21	97.1	86.4	98.4	98.9	98.8	99.6	95.5	90.6	85.6	93.9	70.8	84.5	97.3	40.3	85.0
EBCD21	97.7	86.1	98.3	99.3	98.6	99.7	94.0	89.1	85.8	93.9	71.7	84.6	97.0	38.6	85.9
ECAA21	96.8	88.0	98.4	98.1	99.3	99.3	95.3	90.9	84.8	92.4	71.4	85.2	97.7	38.3	84.0
ECAB21	97.2	87.4	98.4	98.6	99.0	99.5	94.8	90.7	84.9	92.6	71.1	85.6	97.6	37.6	84.2
ECAC21	98.0	86.8	98.4	99.0	98.7	99.7	94.6	90.1	85.0	93.6	71.5	85.3	97.4	38.0	84.8
ECAD21	97.9	86.2	98.4	99.3	99.0	99.9	94.8	90.4	84.8	92.9	71.5	85.2	97.1	39.5	84.7
ECBB21	97.3	87.4	98.3	98.8	98.8	99.6	94.3	89.9	85.5	93.6	71.5	85.1	97.5	36.7	85.3
ECBC21	98.0	86.1	98.4	99.1	98.9	99.7	95.4	90.6	85.4	93.0	71.6	85.4	97.2	39.7	85.0
ECBD21	98.4	85.2	98.4	99.5	99.0	99.9	94.2	89.3	85.6	94.1	72.0	84.9	96.9	37.7	85.6
ECCC21	99.0	82.8	98.5	98.6	99.3	99.6	96.1	91.5	85.1	94.2	68.3	84.9	98.1	36.7	83.4
ECCD21	98.7	82.4	98.4	99.2	99.4	99.8	95.7	91.3	85.3	94.1	68.7	85.0	98.0	37.7	83.5
EDAA21	98.0	86.2	98.5	97.5	99.8	99.1	97.1	92.1	83.4	93.7	68.6	85.5	98.2	39.3	82.4
EDAB21	97.9	83.2	98.5	97.9	99.5	99.3	97.1	92.3	83.2	93.9	68.6	85.7	98.1	39.0	82.3

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EDAC21	98.0	83.0	98.4	98.5	99.5	99.5	96.3	91.2	83.5	92.9	68.4	87.0	97.9	36.7	83.5
EDBB21	98.1	82.9	98.4	98.1	99.5	99.3	97.4	91.5	83.8	92.9	68.5	86.6	97.9	39.1	83.6
EDBC21	98.7	82.0	98.5	98.7	99.4	99.6	96.5	90.8	84.3	94.3	68.6	84.9	97.8	38.3	83.9
EDBD21	98.7	81.9	98.5	99.2	99.5	99.8	95.9	91.2	84.3	93.4	68.2	85.6	97.8	37.2	83.2
EDCC21	98.8	81.9	98.5	98.5	99.3	99.5	96.3	91.3	84.5	93.5	68.2	85.7	97.7	39.6	83.5
EBAE31	94.8	86.1	97.9	99.7	98.7	99.6	92.7	89.4	86.5	92.0	78.8	87.8	95.8	34.6	87.0
EBAE32	92.9	80.0	97.5	99.6	98.3	99.2	93.1	87.5	88.6	87.3	86.7	90.8	95.3	39.4	88.6
EBAE33	92.0	74.1	97.1	99.5	98.6	98.9	92.9	86.4	90.0	84.0	87.0	94.0	94.9	37.9	89.3
EBAE41	94.0	84.4	97.7	99.7	98.8	99.5	91.7	88.6	87.7	88.4	79.4	89.6	95.1	33.8	87.9
EBAE42	90.9	78.8	97.4	99.5	98.5	99.1	91.2	86.2	89.4	84.7	86.4	90.5	94.7	36.4	89.8
EBAE43	90.1	73.1	97.0	99.5	98.4	98.8	91.1	84.9	90.6	82.0	86.8	96.4	95.0	37.5	90.3
EBAE51	86.3	75.5	97.9	99.7	99.2	99.3	90.2	88.0	88.5	87.3	79.9	89.3	94.7	33.6	88.0
EBAE52	84.7	72.5	97.4	99.6	98.5	98.8	89.9	85.1	90.1	84.4	87.7	90.1	94.4	34.8	90.6
EBAE53	83.4	69.6	96.9	99.6	98.2	98.4	90.7	82.8	91.5	81.4	92.1	96.4	93.7	41.8	92.6
EBAE61	93.8	69.1	98.0	98.2	98.7	98.8	93.9	96.4	89.1	88.8	78.7	90.1	95.8	35.7	86.9
EBAE62	92.1	63.2	97.5	97.9	98.4	98.2	93.4	95.5	90.9	86.5	83.2	92.9	95.9	37.9	87.8
EBAE63	88.5	59.8	97.0	97.6	98.1	97.7	94.7	92.4	92.2	80.8	89.8	99.1	94.9	41.3	90.0
EBAE71	93.6	76.8	98.0	99.7	99.2	99.5	92.5	89.9	89.5	87.6	79.9	89.3	95.6	33.8	85.4
EBAE72	90.7	72.9	97.3	99.6	98.5	99.0	93.0	86.8	91.3	84.3	90.0	90.6	94.9	39.0	88.5
EBAE73	88.4	70.4	96.7	99.5	97.9	98.5	91.6	83.1	92.6	80.4	92.1	96.7	93.8	40.8	91.6
EBAE81	87.4	65.5	98.1	98.0	99.7	98.6	93.5	100.0	89.5	89.4	72.6	89.9	97.1	38.0	82.4
EBAE82	85.2	55.1	97.6	97.6	99.2	97.9	96.3	99.6	90.7	87.7	83.8	91.1	95.9	42.0	84.2
EBAE83	83.8	49.7	97.2	97.4	99.2	97.5	96.8	98.4	91.5	84.0	87.9	96.4	94.3	39.2	84.8
EBAE91	85.5	74.4	98.1	99.7	99.2	99.3	91.1	89.6	90.3	86.3	77.9	90.1	95.5	34.6	85.9
EBAE92	83.9	71.0	97.4	99.6	98.6	98.7	91.7	85.9	92.1	84.0	89.3	90.2	94.8	37.0	89.1
EBAE93	84.4	66.0	96.9	99.5	98.4	98.4	91.0	84.1	93.0	81.5	86.9	94.4	95.1	38.8	89.8
GAAA21	96.4	91.3	98.6	93.0	99.5	97.4	95.3	93.3	84.8	92.3	69.8	85.8	99.2	35.0	79.5
GAAB21	96.5	87.5	98.7	93.5	99.2	97.5	97.5	94.2	84.4	90.8	69.6	86.7	99.3	35.4	80.0
GAAC21	96.6	87.0	98.6	93.8	99.3	97.7	96.3	93.8	84.7	91.2	69.9	87.3	99.4	34.5	80.2
GAAD21	96.8	87.5	98.7	94.2	98.9	97.8	96.3	92.5	84.7	90.9	71.3	87.5	98.7	38.6	80.9
GAAE21	96.3	85.6	98.6	94.3	99.3	97.8	94.6	92.1	84.7	92.5	71.0	84.4	98.6	37.5	81.3
GABB21	95.9	84.6	98.7	93.8	99.5	97.7	98.8	94.7	84.4	91.2	68.7	86.3	99.5	33.8	78.6
GABC21	96.4	84.1	98.7	94.5	99.5	97.9	97.9	94.3	84.6	91.3	68.5	87.4	99.6	33.0	79.2
GABD21	95.2	84.3	98.6	94.9	99.5	98.0	96.2	93.4	85.0	91.4	68.6	87.3	99.3	32.4	79.7
GACC21	95.7	84.1	98.6	94.5	99.4	97.8	96.7	93.6	85.2	91.7	68.4	87.4	99.3	33.8	79.9
GACD21	96.8	83.6	98.6	94.6	99.4	97.9	96.4	92.7	85.1	91.3	68.2	87.2	99.2	33.6	80.4
GBAA21	95.1	85.3	98.6	97.4	99.5	99.1	98.9	94.4	84.6	91.8	69.7	86.0	99.3	36.5	79.1
GBAB21	95.2	85.3	98.7	98.1	99.7	99.4	97.4	94.4	84.9	91.7	69.3	86.3	99.4	33.0	78.7
GBAC21	95.9	85.0	98.6	98.5	99.7	99.6	96.9	94.0	85.0	91.8	69.2	87.3	99.5	32.3	79.2
GBAD21	95.2	85.1	98.6	99.0	99.7	99.8	95.4	93.3	85.4	92.0	69.3	87.8	99.2	31.9	79.6
GBBB21	96.0	83.4	98.7	97.9	99.6	99.3	99.8	94.8	84.6	91.0	68.8	87.1	99.8	34.0	78.5

Table A-3. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over the 96-year simulation period (1898-1993).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
GBBC21	95.6	85.0	98.6	98.6	99.6	99.6	96.3	93.4	86.0	92.5	68.8	87.4	99.4	32.7	79.8
GBBD21	96.8	84.3	98.6	99.1	99.6	99.8	95.5	92.6	85.8	93.5	68.8	86.7	99.1	33.2	80.2
GBCC21	96.1	81.5	98.6	98.5	99.5	99.5	97.5	93.0	85.3	91.6	68.4	87.9	99.4	34.3	80.1
GCAA21	95.7	85.0	98.7	97.2	99.8	99.1	100.0	95.1	84.0	91.0	68.9	86.2	100.0	35.3	78.2
GCAB21	96.7	82.1	98.7	97.8	99.8	99.3	98.7	94.6	84.3	91.6	68.3	87.1	99.9	34.0	78.8
GCAC21	96.0	81.3	98.7	98.4	99.7	99.5	97.7	93.8	84.3	92.6	68.8	86.8	99.7	33.7	79.2
GCAD21	95.7	81.3	98.7	99.1	99.7	99.8	96.5	92.8	84.5	91.5	68.7	87.8	99.3	32.9	79.8
GCBB21	96.1	80.7	98.7	98.0	99.7	99.3	98.9	94.1	84.8	92.6	68.5	86.1	99.7	34.6	79.3
GDAA21	97.3	81.0	98.6	96.8	100.0	98.9	99.2	94.5	83.0	91.6	68.7	86.3	99.8	37.1	78.9
EVQ2	0.0	-16.2	37.0	89.1	99.6	61.0	84.8	86.1	100.0	73.4	92.9	100.0	88.0	100.0	92.0
POWER3	76.8	76.3	100.0	94.9	95.0	97.7	93.8	94.7	90.9	82.0	96.8	81.3	98.9	29.4	74.2

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ABAA10	98.0	99.1	90.9	97.6	74.6	94.8	71.2	44.6	92.6	100.0	88.1	77.7	84.3	16.9	99.8
ABAA20	97.9	94.5	93.5	98.6	85.1	97.0	68.3	53.6	93.7	98.5	84.3	78.1	89.7	14.3	92.5
ABAA11	97.7	98.8	90.8	97.6	75.3	94.7	75.6	44.6	92.6	97.4	92.5	76.9	80.3	24.4	100.0
AAAA21	96.9	99.7	94.8	84.4	87.6	91.6	75.2	60.2	91.5	94.3	78.4	79.2	89.9	24.8	91.1
AAAB21	96.9	99.7	94.8	84.4	87.6	91.6	75.2	60.2	91.5	94.3	78.4	79.2	89.9	24.8	91.1
AAAC21	96.9	99.7	94.8	84.4	87.6	91.6	75.2	60.2	91.5	94.3	78.4	79.2	89.9	24.8	91.1
AAAD21	96.9	99.7	94.8	84.4	87.6	91.6	75.2	60.2	91.5	94.3	78.4	79.2	89.9	24.8	91.1
AAAE21	96.9	99.7	94.8	84.4	87.6	91.6	75.2	60.2	91.5	94.3	78.4	79.2	89.9	24.8	91.1
AABB21	97.1	96.9	93.9	85.0	85.7	91.3	74.5	57.7	93.3	94.7	81.9	79.1	88.8	25.1	92.3
AABC21	97.1	96.9	93.9	85.0	85.7	91.3	74.5	57.7	93.3	94.7	81.9	79.1	88.8	25.1	92.3
AABD21	97.1	96.9	93.9	85.0	85.7	91.3	74.5	57.7	93.3	94.7	81.9	79.1	88.8	25.1	92.3
AABE21	97.1	96.9	93.9	85.0	85.7	91.3	74.5	57.7	93.3	94.7	81.9	79.1	88.8	25.1	92.3
AACC21	97.3	94.6	93.1	84.8	81.6	90.6	73.7	55.1	94.6	95.2	89.3	79.2	86.7	25.1	93.4
AACD21	97.3	94.6	93.1	84.8	81.6	90.6	73.7	55.1	94.6	95.2	89.3	79.2	86.7	25.1	93.4
AACE21	97.3	94.6	93.1	84.8	81.6	90.6	73.7	55.1	94.6	95.2	89.3	79.2	86.7	25.1	93.4
AADD21	97.0	86.7	93.2	85.4	83.0	90.9	74.9	55.9	94.7	95.5	84.0	79.6	87.1	26.2	93.1
AADE21	97.0	78.5	92.7	85.9	84.4	90.9	75.2	54.8	95.1	95.5	87.0	78.0	86.3	26.5	93.3
AAEE21	98.1	43.7	91.8	86.3	77.0	89.9	75.2	51.4	92.4	98.4	88.7	73.3	82.6	27.1	95.1
ABAA21	96.8	94.2	93.5	98.6	82.6	96.8	72.8	54.3	94.3	95.3	87.1	79.0	86.7	24.4	92.9
ABAB21	96.8	94.2	93.5	98.6	82.6	96.8	72.8	54.3	94.3	95.3	87.1	79.0	86.7	24.4	92.9
ABAC21	96.8	94.2	93.5	98.6	82.6	96.8	72.8	54.3	94.3	95.3	87.1	79.0	86.7	24.4	92.9
ABAD21	96.8	94.2	93.5	98.6	82.6	96.8	72.8	54.3	94.3	95.3	87.1	79.0	86.7	24.4	92.9
ABAE21	96.8	94.2	93.5	98.6	82.6	96.8	72.8	54.3	94.3	95.3	87.1	79.0	86.8	24.4	92.9
ABBB21	96.8	92.0	93.1	98.1	79.9	96.2	74.9	55.0	95.2	95.5	86.8	78.6	86.1	25.9	92.8
ABBC21	96.9	90.6	93.0	98.3	79.6	96.2	74.4	54.5	95.3	95.4	87.0	78.7	86.1	25.6	93.1
ABBD21	96.9	89.6	92.9	98.5	79.1	96.3	73.9	54.2	95.5	95.5	87.1	79.2	86.0	26.0	93.3
ABBE21	96.8	90.2	92.9	98.9	80.6	96.5	73.4	53.4	95.7	95.4	90.2	78.0	85.3	26.3	93.4
ABCC21	97.1	84.4	93.0	97.9	80.3	96.1	75.0	54.4	96.5	95.8	84.3	78.6	87.0	26.2	93.4
ABCD21	96.9	85.8	92.9	98.2	81.4	96.2	74.8	53.6	96.5	95.8	86.6	79.0	86.2	26.1	93.4
ABCE21	96.9	78.7	92.4	98.9	80.5	96.2	75.2	53.0	96.7	95.6	86.2	76.8	85.8	23.9	93.8
ABDD21	97.3	74.3	92.6	97.8	81.2	95.8	77.4	54.9	97.3	96.0	83.9	79.7	85.8	26.5	93.3
ABDE21	97.4	70.5	92.1	98.9	79.7	95.9	76.0	52.8	97.5	96.7	88.7	77.1	84.2	26.7	94.1
ACAA21	97.1	87.1	93.0	97.9	79.6	96.1	74.3	52.9	96.0	96.3	88.2	78.1	85.5	23.4	94.1
ACAB21	97.1	86.7	92.9	98.2	79.2	96.1	73.4	52.5	96.1	96.3	90.7	78.2	84.6	23.5	94.3
ACAC21	96.8	84.4	93.1	98.1	80.2	96.2	75.6	54.3	95.7	95.8	85.3	79.6	86.5	24.2	93.1
ACAD21	97.1	85.5	93.2	98.2	83.0	96.5	74.0	54.1	95.2	95.8	85.1	78.6	87.2	24.5	93.2
ACAE21	97.1	82.4	92.6	98.9	83.5	96.5	73.1	52.2	95.9	96.1	87.8	77.1	86.3	23.9	94.1
ACBB21	97.1	84.2	92.7	98.1	78.6	95.9	75.7	53.1	96.9	96.2	87.8	78.5	85.2	25.0	93.7
ACBC21	97.2	81.7	92.4	98.5	80.1	96.0	74.8	52.4	97.2	96.1	88.7	78.8	85.4	25.3	94.3
ACBD21	97.9	83.0	92.5	98.9	80.2	96.3	74.5	52.3	97.7	96.5	90.9	78.8	84.7	24.1	94.6
ACBE21	97.8	73.1	92.4	99.5	83.5	96.6	75.7	53.0	96.9	95.7	84.6	77.8	86.4	21.6	93.6
ACCC21	97.2	75.4	92.7	98.2	74.3	95.6	76.5	53.3	98.2	96.0	89.2	78.9	85.2	26.8	94.5

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
ACCD21	97.2	77.1	92.0	98.7	74.6	95.5	74.9	52.0	98.5	96.3	90.8	80.2	84.5	25.0	94.8
ACCE21	97.9	63.7	92.5	99.6	81.5	96.5	76.4	53.2	97.6	96.7	85.6	76.0	84.7	25.6	94.2
ACDD21	97.9	65.4	91.9	98.3	72.3	95.1	77.5	52.8	99.2	96.2	87.1	79.6	83.6	25.8	94.8
ACDE21	98.0	57.1	91.4	99.6	79.1	95.8	74.6	50.0	99.6	98.3	90.3	75.4	82.8	23.4	96.0
ADAA21	97.6	80.9	93.0	96.9	75.7	95.3	76.6	53.7	94.9	96.5	90.5	79.6	85.0	24.7	95.1
ADAB21	97.6	80.2	92.8	97.5	74.4	95.4	75.3	51.8	95.1	96.8	91.0	79.8	84.6	25.5	95.4
ADAC21	97.6	76.3	93.2	97.3	76.0	95.6	76.5	54.1	94.4	96.2	87.5	81.0	85.2	27.9	94.1
ADAD21	97.6	74.3	92.8	98.0	74.5	95.5	75.1	52.7	94.8	96.1	86.8	79.8	86.3	24.6	94.5
ADAE21	98.3	65.7	92.7	98.6	82.0	96.2	76.1	53.2	94.1	95.7	84.5	78.0	86.2	24.3	94.1
ADBB21	97.7	73.2	92.4	97.5	73.3	95.1	77.9	52.7	96.2	96.6	91.0	79.7	83.7	28.6	95.1
ADBC21	97.7	72.2	92.1	98.0	71.5	95.0	76.3	51.1	96.6	96.7	91.6	79.4	84.1	27.8	95.6
ADBD21	98.0	67.7	92.9	98.1	76.9	95.8	78.9	54.9	95.4	96.5	82.3	80.0	85.7	25.1	93.7
ADBE21	98.3	62.4	92.0	99.4	75.1	95.8	76.0	51.9	95.7	97.0	86.4	77.4	84.8	25.1	94.7
ADCC21	97.6	64.1	92.4	97.2	76.0	95.0	77.9	53.2	97.0	96.7	87.5	80.1	85.1	24.7	94.7
ADCD21	97.7	66.0	92.3	98.1	77.6	95.5	75.5	51.8	97.2	97.0	90.9	80.8	83.6	28.6	95.5
ADCE21	98.4	56.2	91.2	99.5	72.7	95.2	74.3	48.6	97.2	98.7	90.2	75.8	82.6	20.9	96.6
ADDD21	98.2	58.1	91.9	93.7	76.7	93.3	77.0	51.9	98.1	98.7	90.5	78.4	82.8	24.6	95.2
ADDE21	100.0	41.1	91.8	95.5	80.3	94.2	74.5	49.4	98.2	99.2	81.9	75.3	84.1	19.1	96.7
ABAE31	95.4	92.0	93.0	98.6	84.1	96.6	73.8	55.7	96.1	91.3	92.3	84.4	86.6	20.7	92.8
ABAE32	93.0	89.8	92.6	98.5	83.1	96.2	73.2	52.9	97.3	89.3	96.3	86.4	85.4	26.1	94.1
ABAE33	93.0	86.3	91.6	98.4	81.6	95.5	73.1	50.8	98.0	87.2	100.0	88.6	84.2	25.1	96.2
ABAE41	94.3	90.9	92.9	98.6	83.8	96.4	73.1	54.7	96.5	90.6	92.5	83.6	86.2	22.9	93.5
ABAE42	93.0	88.7	92.4	98.5	82.5	96.0	72.6	52.1	97.7	87.6	95.2	86.9	85.5	26.3	95.0
ABAE43	92.5	85.1	91.4	98.4	81.1	95.3	72.2	48.8	98.3	85.3	97.9	93.5	84.5	24.8	97.4
ABAE51	91.6	89.6	92.3	98.5	80.1	95.8	72.9	53.0	96.9	90.0	89.4	82.9	85.8	22.1	94.0
ABAE52	90.5	79.7	92.7	98.4	82.8	95.9	73.3	53.5	97.9	87.1	88.7	86.4	85.2	23.5	94.9
ABAE53	90.8	76.5	92.0	98.3	81.9	95.5	73.4	50.7	98.1	85.0	91.1	90.1	84.2	22.6	96.8
ABAE61	93.8	58.5	93.3	95.9	78.0	94.8	80.7	64.5	98.0	89.1	79.6	86.3	86.9	19.3	90.7
ABAE62	91.9	53.3	92.6	95.5	76.4	94.0	81.3	61.0	99.4	86.6	82.1	90.3	86.0	24.2	92.9
ABAE63	90.4	53.9	91.7	95.5	76.5	93.6	76.0	54.7	99.7	87.2	86.5	90.5	83.9	21.6	96.8
ABAE71	93.9	83.3	93.1	98.6	84.4	96.5	73.9	55.7	97.8	89.5	90.8	83.1	87.0	20.3	92.3
ABAE72	91.7	77.3	92.7	98.5	84.2	96.1	73.9	54.1	99.3	86.4	92.1	86.0	86.4	26.3	93.6
ABAE73	90.4	74.7	91.9	98.5	82.4	95.5	73.6	50.8	100.0	83.0	97.6	92.2	85.1	27.5	95.6
ABAE81	91.0	58.5	93.3	95.6	77.9	94.5	81.0	64.5	98.2	89.3	79.2	84.8	86.7	21.7	90.8
ABAE82	89.9	51.4	92.5	95.5	75.8	93.9	81.1	59.1	99.7	87.2	82.2	87.9	85.6	25.2	93.5
ABAE83	88.6	53.7	91.4	95.5	75.9	93.3	75.9	53.7	99.7	87.6	85.8	88.2	83.6	23.3	97.3
ABAE91	90.9	80.5	93.1	98.6	84.4	96.3	73.8	55.4	98.2	88.9	90.4	83.5	86.6	23.7	92.4
ABAE92	89.4	77.3	92.7	98.5	84.1	96.0	73.6	53.7	99.5	86.3	93.3	83.9	85.7	25.9	93.7
ABAE93	88.3	75.0	91.7	98.4	81.8	95.3	73.0	49.8	100.0	83.8	98.2	90.2	84.7	27.0	96.0
BAAA21	97.0	99.4	94.9	84.6	88.1	91.7	73.9	60.4	91.3	94.3	80.1	79.5	89.7	25.3	90.9
BAAB21	97.0	99.4	94.9	84.6	88.1	91.7	73.9	60.4	91.3	94.3	80.1	79.5	89.7	25.3	90.9

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BAAC21	97.0	99.4	94.9	84.6	88.1	91.7	73.9	60.4	91.3	94.3	80.1	79.5	89.7	25.3	90.9
BAAD21	97.0	99.4	94.9	84.6	88.1	91.7	73.9	60.4	91.3	94.3	80.1	79.5	89.7	25.3	90.9
BAAE21	97.0	99.4	94.9	84.6	88.1	91.7	73.9	60.4	91.3	94.3	80.1	79.5	89.7	25.3	90.9
BABB21	97.1	96.2	95.3	84.3	86.0	91.7	75.0	61.0	92.7	95.0	79.1	79.7	89.2	21.8	90.6
BABC21	97.1	95.9	95.2	84.6	85.6	91.7	74.6	60.6	92.8	94.9	79.4	80.4	89.5	21.5	90.8
BABD21	97.2	95.8	95.0	84.8	86.7	91.7	74.3	60.2	93.0	95.0	80.9	80.4	89.2	23.9	91.0
BABE21	97.1	90.7	95.0	85.1	88.5	92.0	74.8	60.3	92.7	94.8	78.2	78.9	88.9	22.2	90.5
BACC21	97.1	91.9	95.0	84.5	85.6	91.5	77.2	61.1	93.6	94.8	79.9	81.0	88.6	24.6	90.7
BACD21	97.2	90.2	94.8	84.9	85.0	91.6	76.2	60.3	93.7	94.8	79.6	80.9	89.2	22.7	91.1
BACE21	97.1	83.6	94.6	85.5	86.7	91.8	75.8	60.0	93.9	94.9	78.8	78.9	88.9	25.4	91.3
BADD21	97.3	83.0	94.3	85.1	83.7	91.3	76.5	59.7	94.5	95.2	79.9	80.8	88.7	25.0	91.8
BADE21	97.2	66.5	94.4	85.9	85.4	91.7	77.4	59.7	94.1	95.4	81.2	78.9	87.2	26.7	91.3
BBAA21	97.2	95.3	95.2	97.6	86.7	97.4	75.4	60.1	93.1	94.8	82.0	80.1	88.7	25.3	91.3
BBAB21	96.8	93.2	95.7	97.0	87.6	97.4	77.6	62.5	92.7	94.6	76.9	79.4	89.6	24.0	89.4
BBAC21	96.9	92.1	95.4	97.4	87.2	97.4	76.4	61.2	93.0	94.8	78.3	80.2	88.9	23.7	89.9
BBAD21	97.2	91.8	95.3	97.8	86.5	97.5	75.4	60.1	93.0	94.8	78.1	80.1	88.9	23.0	90.4
BBAE21	97.2	90.0	94.8	98.4	85.0	97.5	74.2	58.8	93.1	95.0	80.9	78.2	88.8	23.0	91.4
BBBB21	97.3	90.4	94.8	97.5	84.7	97.0	77.6	59.7	94.4	95.0	79.3	79.5	88.4	23.5	91.0
BBBC21	97.4	91.4	94.9	97.9	84.2	97.3	76.4	59.6	94.8	95.3	81.1	80.8	88.6	25.2	91.7
BBBD21	96.8	90.1	94.7	98.3	82.9	97.2	75.1	58.0	95.1	95.5	82.4	80.1	88.2	28.0	92.3
BBBE21	97.7	71.8	95.1	98.7	83.3	97.5	78.7	60.3	94.0	95.0	77.3	78.3	88.4	27.0	90.2
BBCC21	97.1	77.6	94.8	97.0	85.2	96.7	78.9	60.5	95.4	95.4	80.6	80.5	87.4	23.9	90.7
BBCD21	96.8	78.3	95.0	97.6	87.3	97.2	76.6	60.3	95.4	95.8	79.2	80.0	87.8	26.6	91.6
BBCE21	97.2	66.4	94.4	98.8	85.6	97.3	77.0	58.5	95.4	95.7	79.4	78.7	87.6	26.2	91.5
BBDD21	97.7	66.8	94.7	97.2	84.0	96.7	79.4	60.2	96.2	96.0	78.6	79.8	87.1	26.3	91.1
BBDE21	97.3	57.0	93.9	98.9	82.5	96.8	76.8	57.4	96.5	97.0	82.8	76.1	86.2	29.5	92.6
BCAA21	96.8	90.2	94.7	96.9	85.1	96.8	78.1	59.5	94.6	95.8	82.3	79.5	88.0	26.1	92.0
BCAB21	96.8	89.2	94.5	97.5	84.4	96.8	76.5	58.2	94.9	95.8	84.2	79.4	87.6	25.1	92.6
BCAC21	96.9	88.0	94.2	97.9	82.1	96.8	75.1	56.5	95.2	95.7	87.2	79.3	87.0	26.3	93.0
BCAD21	96.8	82.3	94.7	97.9	82.3	96.9	76.3	58.0	94.4	95.7	81.0	79.9	87.5	27.4	91.5
BCAE21	97.5	70.1	94.5	98.6	83.9	97.2	77.2	57.9	93.8	95.4	78.5	78.2	87.8	22.1	91.0
BCBB21	96.9	87.6	94.9	97.3	86.3	97.1	77.3	59.9	95.8	96.1	83.0	79.9	87.8	24.8	92.5
BCBC21	96.9	77.6	95.1	97.3	85.1	97.0	77.8	59.9	95.5	96.0	79.1	80.3	87.9	25.7	91.5
HCBD21	96.9	77.2	94.6	98.2	85.0	97.1	76.4	58.4	95.7	96.1	81.9	79.6	87.0	25.8	92.1
BCBE21	96.8	65.6	94.0	99.4	83.4	97.2	76.2	57.0	95.6	95.8	80.4	78.8	87.2	20.8	92.1
BCCC21	97.1	67.0	95.3	96.6	84.2	96.6	81.2	61.9	96.2	96.3	78.3	79.1	88.2	26.1	90.0
BCCD21	97.5	65.4	94.5	97.8	82.2	96.7	79.0	58.7	96.7	96.2	78.7	79.5	87.1	24.3	91.3
BCCE21	98.6	48.2	95.1	99.3	89.5	97.9	77.9	59.9	96.0	96.9	75.5	75.1	88.7	24.9	91.2
BCDD21	97.1	59.9	93.9	97.7	83.4	96.3	77.6	57.9	98.4	96.2	81.5	80.7	86.5	25.7	92.8
BCDE21	99.2	43.9	94.3	99.5	85.4	97.4	77.4	58.6	98.1	97.4	74.1	74.7	87.3	24.4	92.2
BDAA21	97.2	85.3	95.1	95.7	86.7	96.5	76.6	60.3	93.0	98.8	83.9	78.3	87.5	23.1	92.5
BDAB21	97.0	72.3	94.6	96.2	85.0	96.2	79.3	59.6	93.3	96.2	82.4	80.8	86.6	25.8	92.1

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
BDAC21	97.1	75.6	94.5	96.6	83.6	96.3	76.7	58.2	93.5	95.9	82.3	80.4	87.3	24.6	92.8
BDAD21	97.4	66.5	95.3	96.8	84.3	96.7	79.4	61.0	92.7	96.5	77.8	79.9	87.8	25.4	90.3
BDAE21	97.0	58.9	94.4	98.4	86.0	97.0	77.0	57.7	92.9	96.0	80.9	79.1	87.3	26.0	92.4
BDBB21	97.2	70.7	95.5	95.7	86.7	96.5	80.3	62.0	94.1	96.2	78.7	79.3	88.4	27.9	91.8
BDBC21	97.5	65.5	94.8	96.5	83.2	96.3	81.1	60.5	94.3	96.6	80.1	79.6	87.1	25.9	90.8
BDBD21	97.5	60.1	95.3	97.3	86.6	97.0	80.1	62.0	94.3	96.6	77.3	79.6	88.1	25.1	91.1
BDBE21	97.8	51.8	94.7	99.1	88.3	97.6	76.7	58.9	94.3	97.9	77.6	76.3	87.4	24.0	92.6
BDCC21	97.8	58.8	94.7	96.1	85.2	96.2	80.9	60.4	95.5	96.8	78.9	79.2	87.1	26.7	92.0
BDCD21	97.1	58.5	93.7	97.5	82.5	96.1	77.8	57.1	96.3	96.4	81.9	81.3	86.3	24.1	93.4
BDCE21	99.4	43.8	94.6	99.2	89.6	97.7	78.0	59.6	95.2	97.7	71.5	76.5	88.1	22.1	91.9
BDDD21	97.8	51.6	94.2	96.9	87.0	96.4	77.6	59.3	97.0	98.8	79.9	76.9	86.4	22.8	93.5
BBAE31	94.5	85.7	94.3	98.4	86.4	97.2	74.5	60.9	95.0	90.7	86.4	84.8	88.5	18.4	91.1
BBAE32	92.7	77.8	94.5	98.3	87.7	97.1	76.4	60.6	96.5	89.0	86.2	85.9	87.6	24.6	91.7
BBAE33	92.8	72.9	93.4	98.3	85.9	96.5	76.0	57.1	97.2	87.0	87.7	88.5	87.9	22.9	94.2
BBAE41	93.6	78.6	94.5	98.3	88.2	97.2	75.5	61.9	96.0	89.1	83.9	84.6	87.8	19.9	91.3
BBAE42	92.4	74.4	94.1	98.3	86.6	96.8	75.0	58.3	97.2	86.2	86.0	87.7	87.3	23.6	92.9
BBAE43	92.2	70.6	93.1	98.2	85.6	96.2	75.1	55.3	98.1	83.1	87.4	94.1	87.6	22.6	95.5
BBAE51	90.8	76.6	94.5	98.4	85.6	96.9	75.5	60.7	96.5	88.2	81.1	84.6	87.5	20.9	91.6
BBAE52	90.2	73.7	93.7	98.3	85.2	96.4	74.6	56.0	97.5	85.9	83.3	86.4	87.2	23.5	93.9
BBAE53	90.4	68.6	93.0	98.3	82.6	95.9	75.1	54.4	98.1	83.7	85.9	91.2	86.0	24.7	96.1
BBAE61	92.9	56.5	94.6	95.9	82.9	95.7	79.5	68.7	97.1	86.6	78.1	88.4	87.9	19.3	89.2
BBAE62	90.7	48.7	94.2	95.6	86.8	95.4	80.5	66.5	98.9	85.9	81.1	90.8	86.8	22.0	92.1
BBAE63	86.5	44.7	94.1	95.3	85.6	94.9	80.5	64.2	98.9	79.3	81.7	97.3	86.0	23.1	93.0
BBAE71	93.6	79.5	94.6	98.5	87.0	97.2	74.6	60.7	97.3	88.2	86.0	84.2	89.0	18.5	90.4
BBAE72	91.8	73.4	94.1	98.4	86.6	96.8	74.9	59.3	98.8	85.6	88.6	86.2	88.3	24.4	91.9
BBAE73	89.7	62.6	93.7	98.3	86.7	96.4	76.0	58.0	99.0	82.2	88.5	92.5	86.9	24.6	93.5
BBAE81	89.9	56.5	94.6	95.6	82.8	95.4	79.6	68.6	97.5	87.1	77.4	87.5	87.9	21.1	89.3
BBAE82	88.7	47.8	94.0	95.6	86.5	95.2	80.1	65.3	99.2	86.2	80.6	88.3	87.1	22.9	92.7
BBAE83	89.3	47.6	92.4	95.5	79.0	94.0	80.3	59.3	99.3	82.6	80.8	92.5	85.8	25.4	95.0
BBAE91	90.1	76.6	94.6	98.4	87.0	97.1	74.3	60.7	97.6	87.5	84.6	84.4	88.7	20.5	90.7
BBAE92	88.7	70.0	94.0	98.4	86.2	96.6	74.8	58.9	98.9	85.2	88.8	84.0	87.5	23.8	92.1
BBAE93	87.6	62.2	93.5	98.3	86.2	96.2	75.6	57.2	99.0	82.3	87.7	90.5	86.8	24.9	94.1
CAAA21	97.0	98.9	96.4	84.9	92.2	92.8	77.3	67.2	91.1	94.7	77.5	80.5	91.0	22.9	88.4
CAAB21	96.5	100.0	96.3	83.8	92.0	92.3	76.3	65.2	90.9	94.6	78.7	81.2	90.7	23.8	89.0
CAAC21	96.5	99.7	96.2	84.0	90.4	92.2	75.7	64.9	91.2	94.5	78.4	82.0	90.7	24.9	89.5
CAAD21	96.6	99.5	96.0	84.2	91.4	92.3	75.1	64.6	91.2	94.5	77.4	80.9	91.1	23.5	89.7
CAAE21	96.7	92.7	96.1	85.7	89.5	92.8	75.3	64.7	91.1	94.7	75.5	79.3	90.9	23.2	89.3
CABB21	95.9	85.5	96.6	84.6	92.2	92.6	77.1	68.9	92.3	94.4	74.6	80.6	91.8	26.1	86.9
CABC21	96.3	84.2	96.6	85.1	89.8	92.7	76.3	66.7	92.6	96.0	74.6	79.8	91.4	26.0	87.9
CABD21	96.5	88.1	96.5	85.3	90.8	92.8	77.0	67.0	92.2	95.3	75.2	80.3	91.0	23.6	88.5
CABE21	96.7	81.0	96.3	86.1	90.4	93.0	76.3	65.2	92.5	95.4	74.2	77.7	91.0	24.0	89.1

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CACC21	96.9	86.6	95.9	85.1	88.6	92.4	77.7	65.4	93.4	95.5	76.0	80.1	90.2	24.1	89.8
CACD21	96.7	81.2	96.2	85.4	89.0	92.6	77.6	65.9	93.3	95.4	73.1	80.2	91.0	25.7	89.0
CACE21	97.2	65.1	95.7	86.6	88.5	92.7	78.2	65.0	93.4	95.6	74.7	78.0	90.0	22.5	89.7
CADD21	96.7	75.6	95.9	84.4	90.4	92.1	77.9	65.3	94.0	95.6	74.5	79.9	90.4	25.2	90.0
CADE21	97.4	55.9	95.9	87.0	87.9	92.9	78.8	64.8	94.2	95.9	73.0	76.7	89.3	26.9	89.5
CBAA21	96.9	94.7	96.2	96.2	89.0	97.4	76.7	64.4	92.9	95.5	77.3	80.6	90.3	22.8	89.7
CBAB21	96.3	84.2	96.5	96.0	89.5	97.4	77.0	65.9	92.5	95.9	74.9	80.0	90.9	26.3	88.1
CBAC21	96.8	85.5	96.3	96.7	88.5	97.5	75.9	64.6	92.7	95.5	74.7	80.9	90.5	24.0	88.9
CBAD21	96.9	87.0	96.3	97.3	89.8	97.9	76.2	64.7	92.5	95.2	76.5	80.9	90.3	22.3	89.4
CBAE21	96.9	80.6	95.9	98.2	89.6	98.1	75.5	62.4	92.8	95.3	75.8	78.0	89.7	22.7	90.1
CBBB21	96.9	86.9	96.0	96.6	88.9	97.4	79.1	65.3	93.9	95.4	75.9	79.8	90.3	23.6	89.8
CBBC21	97.3	92.0	95.9	97.2	88.5	97.7	77.3	63.9	94.5	95.5	77.1	80.9	89.8	23.7	90.3
CBBD21	97.1	80.5	96.1	97.5	87.8	97.7	77.6	64.3	94.0	95.5	74.6	81.6	90.4	25.5	89.7
CBBE21	97.4	62.2	96.2	98.6	90.3	98.3	79.2	65.3	93.5	95.5	71.9	77.6	90.7	25.4	89.2
CBCC21	96.8	69.7	96.3	96.6	88.7	97.4	80.5	67.4	95.3	95.4	74.5	80.9	90.3	23.6	89.3
CBCD21	97.0	74.3	95.9	97.3	88.9	97.6	78.0	64.1	95.2	95.5	75.3	79.2	89.5	25.4	90.5
CBCE21	97.5	55.9	96.2	98.7	87.3	98.1	78.7	65.4	94.5	95.6	72.1	77.4	90.3	22.1	89.1
CBDD21	95.8	55.5	96.5	96.5	93.2	97.6	79.1	71.3	96.0	95.0	71.0	78.2	91.6	26.2	87.5
CBDE21	98.4	45.3	95.7	98.8	89.5	98.0	78.9	64.8	96.5	97.1	70.5	75.3	89.5	24.9	89.5
CCAA21	97.1	92.0	96.0	95.7	89.7	97.1	80.3	66.3	93.7	96.0	77.1	78.8	89.7	21.7	88.9
CCAB21	96.7	90.8	95.8	96.5	88.7	97.3	78.3	63.4	94.0	95.7	78.8	79.9	88.6	21.3	90.4
CCAC21	96.8	89.1	95.5	97.2	86.9	97.3	76.6	61.7	94.4	95.7	80.6	79.1	88.3	22.6	91.5
CCAD21	96.9	79.2	95.5	97.3	86.5	97.3	76.3	61.6	93.9	95.5	77.6	79.7	89.2	23.6	90.8
CCAE21	97.6	61.9	96.0	98.3	90.0	98.1	78.4	64.3	92.8	95.7	74.5	76.9	89.8	22.3	89.8
CCBB21	96.8	87.8	96.2	96.8	90.7	97.7	80.4	66.1	95.1	95.7	75.8	79.3	89.7	23.0	89.5
CCBC21	97.1	68.7	96.0	97.1	87.9	97.4	80.2	66.0	95.1	95.8	76.4	79.1	89.7	24.2	90.2
CCBD21	96.8	73.2	95.7	97.8	88.1	97.6	77.8	62.0	95.4	95.8	78.2	78.7	88.4	26.0	91.4
CCBE21	97.6	54.7	96.2	99.1	90.3	98.4	77.7	64.9	94.3	96.9	71.8	75.6	90.2	21.6	89.9
CCCC21	96.5	61.1	96.1	96.0	86.4	96.8	81.9	66.5	95.7	96.0	74.0	79.2	90.8	27.4	89.0
CCCD21	96.4	63.8	96.8	97.1	93.0	98.0	77.9	69.9	95.8	96.7	72.3	77.4	91.7	24.5	88.1
CCCE21	98.7	45.3	96.1	99.2	91.6	98.5	79.3	65.1	95.9	97.0	69.6	75.8	89.9	25.5	89.3
CCDD21	97.6	51.2	96.5	96.6	90.6	97.5	81.2	69.1	97.4	96.2	68.7	78.5	90.4	26.9	88.4
CDAA21	97.0	86.0	96.2	94.6	91.4	96.8	81.4	66.8	92.5	96.1	77.5	78.7	89.7	24.7	89.4
CDAB21	97.0	84.5	95.8	95.7	89.7	97.0	79.2	64.5	93.1	96.1	78.0	79.4	89.0	24.2	91.0
CDAC21	97.1	71.9	95.9	95.9	87.2	96.8	78.8	63.1	92.7	96.0	77.5	79.5	88.8	27.3	91.1
CDAD21	96.5	62.1	96.2	96.3	88.1	97.1	80.2	65.9	92.2	96.0	74.1	79.8	90.9	27.0	89.2
CDAE21	97.4	54.0	96.0	98.1	91.2	97.9	76.9	64.1	91.7	97.2	70.9	76.3	91.0	18.7	90.5
CDBB21	97.4	64.2	96.0	95.4	89.0	96.8	82.4	66.4	93.6	95.4	76.6	80.4	89.5	23.9	89.5
CDBC21	96.8	61.3	95.9	95.9	85.9	96.6	82.1	65.3	93.6	96.2	75.2	79.5	90.3	27.0	89.7
CDBD21	97.0	55.9	96.3	97.1	92.3	97.7	79.5	68.1	93.9	97.5	71.3	76.8	91.4	22.8	89.9
CDBE21	99.0	45.5	96.2	99.0	91.7	98.5	79.6	66.2	93.4	97.2	65.3	76.3	91.2	23.4	89.5
CDCC21	97.4	55.9	96.0	95.6	90.8	96.9	80.4	67.2	95.0	97.9	72.7	76.8	90.3	23.4	90.5

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
CDCD21	97.0	50.6	96.6	96.4	91.5	97.4	81.5	69.3	95.0	97.5	68.4	77.6	90.8	27.6	88.7
CDDD21	97.5	47.8	96.2	96.3	93.8	97.4	80.8	68.5	96.6	98.7	67.6	76.5	89.1	24.1	89.8
CBAE31	94.6	77.0	95.3	98.3	89.5	97.7	75.0	65.4	94.5	90.8	80.2	84.4	89.8	13.8	89.6
CBAE32	92.3	73.3	95.0	98.2	87.1	97.2	75.4	62.6	96.2	88.9	82.4	87.2	89.3	20.4	91.0
CBAE33	90.4	58.3	94.7	98.1	87.5	96.8	77.4	62.8	96.8	83.9	81.3	91.3	89.4	21.8	91.1
CBAE41	93.4	74.7	95.1	98.3	87.7	97.4	74.6	64.5	95.6	87.4	80.5	85.8	89.4	18.4	90.5
CBAE42	91.8	71.3	94.8	98.2	88.1	97.1	74.1	61.3	96.8	85.9	81.1	87.6	89.1	21.2	91.9
CBAE43	91.4	62.5	94.5	98.1	89.3	96.9	75.3	61.6	97.5	83.0	83.2	95.0	88.7	20.4	93.6
CBAE51	90.2	72.0	95.2	98.3	88.8	97.3	74.5	63.7	96.3	86.5	77.6	86.7	89.0	18.8	90.5
CBAE52	87.7	57.9	95.2	98.1	88.8	97.0	76.8	63.7	97.0	83.1	79.5	89.4	88.8	21.4	91.1
CBAE53	86.5	53.8	94.6	98.1	87.9	96.6	77.3	61.8	97.5	80.2	81.9	95.3	87.7	22.9	93.5
CBAE61	92.1	52.9	95.5	95.7	89.5	96.3	79.9	74.4	96.6	86.1	74.7	89.1	89.8	18.1	88.0
CBAE62	88.3	49.5	95.8	95.6	92.0	96.4	78.0	76.3	98.4	86.9	71.7	89.7	91.2	18.7	89.2
CBAE63	85.7	46.0	95.1	95.4	90.0	95.7	77.2	69.9	99.2	82.8	73.3	93.8	89.8	18.2	92.8
CBAE71	92.0	69.5	95.6	98.4	90.1	97.7	75.1	65.8	96.8	86.4	79.7	84.5	90.5	13.6	88.6
CBAE72	88.6	62.8	95.1	98.3	89.7	97.2	75.3	64.4	98.5	83.0	83.2	87.8	89.9	21.6	90.1
CBAE73	86.6	57.5	94.1	98.2	88.0	96.5	75.0	60.2	99.3	79.3	84.8	94.2	88.4	22.8	93.0
CBAE81	88.9	52.8	95.6	95.5	89.2	96.1	80.1	74.1	96.9	86.4	73.3	88.3	89.6	19.8	87.9
CBAE82	85.9	49.2	95.7	95.6	92.9	96.3	77.3	75.0	98.8	87.5	71.9	87.4	90.5	19.1	89.9
CBAE83	84.8	46.0	94.7	95.4	90.8	95.5	76.9	68.9	99.3	82.9	73.4	91.4	89.5	19.5	93.5
CBAE91	88.1	66.2	95.6	98.3	90.2	97.5	74.7	66.6	97.1	85.8	79.1	85.1	90.3	17.8	88.8
CBAE92	86.3	61.3	94.9	98.3	89.3	97.0	75.3	64.1	98.8	82.6	83.5	85.7	89.0	20.6	90.5
CBAE93	84.4	51.2	94.5	98.1	88.8	96.5	77.2	62.6	98.5	79.3	81.3	93.1	88.8	24.0	91.4
DAAA21	95.4	97.9	97.8	84.1	96.2	93.3	79.0	72.9	90.2	94.4	74.6	80.7	93.0	27.5	83.3
DAAB21	95.7	96.4	97.7	84.5	95.4	93.4	78.5	71.7	90.4	94.8	73.2	79.9	93.5	26.5	84.7
DAAC21	95.0	88.5	97.6	84.3	93.3	93.0	78.3	72.1	90.3	92.8	72.2	82.3	93.5	28.3	84.0
DAAD21	95.7	97.3	97.7	84.9	95.9	93.6	77.8	73.6	90.5	93.3	72.9	82.3	93.1	24.5	82.9
DAAE21	95.8	91.8	97.5	85.7	94.2	92.7	76.4	69.8	90.5	95.0	71.4	78.3	93.2	25.5	86.0
DABB21	95.5	96.4	97.7	84.2	94.8	93.2	80.9	74.5	91.8	94.1	73.9	81.5	93.3	24.1	82.8
DABC21	96.3	95.2	97.4	84.8	94.1	93.3	78.9	72.1	92.1	94.4	72.4	80.6	92.9	24.3	84.4
DABD21	95.5	79.7	97.8	85.5	93.3	93.6	76.6	72.2	91.7	95.1	74.2	80.9	92.1	25.4	84.1
DABE21	94.5	61.2	97.4	86.1	93.5	93.5	79.2	72.1	91.2	91.4	69.1	80.3	93.1	28.4	83.6
DACC21	94.9	70.5	98.0	83.9	95.6	93.0	83.2	78.7	92.3	91.9	66.1	82.2	94.1	26.4	79.6
DACD21	94.9	70.5	98.0	83.9	95.6	93.0	83.2	78.7	92.3	91.9	66.1	82.4	94.1	26.4	79.6
DACE21	95.6	51.4	97.7	86.6	96.4	94.0	82.2	75.9	91.9	93.3	64.2	76.0	93.2	31.9	81.4
DADD21	96.0	58.1	98.0	85.1	95.4	93.5	83.6	79.0	93.4	93.8	66.0	78.7	94.0	33.3	79.9
DBAA21	95.0	73.1	98.4	93.7	96.4	97.5	88.5	81.4	90.9	93.0	68.0	80.6	95.0	29.9	77.6
DBAB21	95.6	73.1	98.3	94.9	97.4	98.1	83.4	79.7	90.9	93.2	67.8	81.0	94.6	27.8	78.9
DBAC21	95.4	74.5	98.2	95.9	96.1	98.4	81.7	78.7	91.3	91.5	68.5	83.0	94.5	25.3	79.5
DBAD21	95.3	70.1	98.2	96.5	96.3	98.7	81.1	78.0	91.7	91.8	66.4	81.9	94.1	25.5	79.6
DBAE21	94.8	60.8	97.6	98.1	93.3	98.7	78.8	71.7	91.2	91.5	70.5	80.8	93.1	26.3	84.3

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DBBB21	95.6	74.6	98.0	95.5	95.5	98.1	83.4	77.7	92.8	92.2	67.9	82.6	93.6	25.8	80.4
DBBC21	95.4	70.0	98.1	96.0	96.1	98.4	83.2	78.2	93.2	92.2	66.1	81.5	93.9	26.4	80.0
DBBD21	95.2	64.1	97.7	96.9	94.9	98.5	82.3	75.6	93.2	91.0	68.1	82.5	93.7	26.4	82.2
DBBE21	95.7	51.2	98.1	100.0	97.1	100.0	82.9	77.0	92.2	93.0	61.9	77.1	94.5	30.7	80.3
DBCC21	95.2	64.1	97.5	95.8	94.3	97.8	83.0	74.7	94.5	91.9	69.0	81.4	92.9	27.1	83.9
DBCD21	96.3	57.8	98.3	96.3	95.8	98.5	83.7	79.7	93.5	93.4	65.1	79.9	94.2	32.2	79.1
DBDD21	95.7	51.2	98.0	96.1	96.3	98.2	83.8	79.6	95.2	94.0	61.9	78.1	94.2	31.8	79.8
DCAA21	95.1	74.3	98.2	93.9	96.4	97.5	85.3	79.2	91.6	92.9	69.2	79.0	94.2	30.0	79.5
DCAB21	95.4	74.3	97.9	95.3	95.2	98.0	82.0	75.9	92.2	92.6	69.4	81.4	92.9	27.8	81.5
DCAC21	95.3	69.5	98.2	95.8	95.5	98.2	81.7	76.2	92.4	92.5	68.1	80.6	92.9	29.0	81.0
DCAD21	94.6	63.9	97.7	96.7	94.5	98.3	80.9	73.7	92.6	91.7	69.7	81.1	93.0	28.6	83.5
DCAE21	95.1	50.9	98.2	98.3	96.8	99.3	81.9	76.2	91.1	92.8	62.1	76.9	94.4	31.3	80.4
DCBB21	94.9	72.4	97.6	95.3	95.4	97.8	82.0	76.7	93.2	93.5	70.7	78.5	93.4	27.2	82.0
DCBC21	94.6	62.0	97.3	96.2	94.5	97.9	81.7	74.6	94.0	93.0	70.5	78.9	93.2	27.5	83.7
DCBD21	95.4	68.6	97.3	97.4	94.4	98.5	78.0	70.9	94.1	94.4	70.8	80.8	92.1	26.7	86.6
DCBE21	96.0	49.8	97.9	99.2	96.5	99.5	80.9	74.9	93.5	93.6	63.3	78.1	93.0	27.5	82.1
DCCC21	95.9	57.7	98.3	95.1	95.4	97.9	84.5	79.6	94.4	93.6	66.0	80.5	93.5	34.5	80.1
DCCD21	95.3	50.9	98.4	96.6	96.5	98.6	84.4	80.1	94.6	93.4	62.2	78.3	94.2	32.2	79.0
DCDD21	96.0	49.8	97.9	96.2	96.5	98.2	82.8	79.7	96.9	94.4	61.7	78.3	93.7	31.3	80.1
DDAA21	94.7	71.4	97.6	92.7	95.7	96.7	85.9	78.6	90.7	94.2	68.1	77.6	93.2	28.9	80.3
DDAB21	94.0	58.2	98.6	93.4	96.0	97.3	88.8	83.2	90.8	92.0	64.0	80.7	95.6	32.1	76.0
DDAC21	95.0	57.6	98.3	94.9	95.3	97.8	84.6	78.7	91.4	92.0	67.0	80.7	93.8	30.8	79.2
DDAD21	95.8	54.1	98.1	96.0	95.4	98.2	83.0	77.4	91.3	92.2	66.7	81.2	93.4	29.5	81.3
DDAE21	96.2	49.3	98.0	98.1	97.5	99.2	80.1	75.8	90.4	93.7	61.8	79.1	94.0	25.5	81.8
DDBB21	95.5	57.7	97.6	94.2	94.3	97.2	85.6	76.0	92.3	93.5	69.0	78.2	92.9	30.6	83.5
DDBC21	95.6	54.1	98.1	95.2	94.9	97.8	85.3	77.7	93.0	92.4	66.6	80.7	93.5	33.0	81.6
DDBD21	96.2	54.6	98.5	96.3	97.1	98.7	83.2	80.1	92.5	95.0	62.7	78.5	93.9	31.1	79.4
DDCC21	95.3	50.6	98.5	94.4	96.2	97.7	86.3	81.2	93.5	94.2	62.8	78.5	93.7	32.4	79.1
DDCD21	95.9	49.3	98.1	96.1	97.2	98.3	83.6	81.5	94.5	94.0	59.2	78.9	94.9	29.0	78.7
DBAE31	92.3	57.7	96.8	98.1	95.0	98.3	78.1	75.7	93.2	91.1	72.5	84.7	92.5	13.4	84.2
DBAE32	89.0	55.1	96.5	98.0	94.4	97.9	78.3	73.4	95.1	87.2	74.9	87.5	92.3	19.0	85.8
DBAE33	89.2	49.3	96.7	98.0	95.4	98.1	79.9	76.5	94.9	83.9	76.1	91.8	91.8	20.8	83.7
DBAE41	90.4	56.3	96.6	98.0	94.8	98.1	77.7	75.1	94.2	87.8	73.0	85.7	92.4	15.4	85.2
DBAE42	89.3	51.3	97.1	98.1	96.0	98.4	79.6	77.9	94.8	83.7	73.2	90.2	92.2	19.4	81.9
DBAE43	87.5	48.6	96.3	98.0	95.3	97.8	79.0	74.5	95.4	79.2	74.1	97.3	91.1	22.1	85.2
DBAE51	87.5	54.1	96.8	98.0	94.6	98.0	77.7	74.7	95.0	86.2	68.9	86.8	92.6	16.3	84.8
DBAE52	85.2	47.3	96.9	98.2	95.6	98.1	79.0	77.7	96.0	83.9	68.7	88.4	93.2	16.2	82.1
DBAE53	84.6	45.8	96.7	98.0	95.0	97.8	79.3	75.2	95.8	79.6	73.0	96.4	90.5	22.7	84.9
DBAE61	90.5	47.5	97.9	96.0	96.4	97.8	81.7	89.5	95.2	85.3	69.7	89.9	93.8	18.1	78.2
DBAE62	86.2	43.8	97.1	95.7	95.5	97.1	81.7	84.7	97.0	82.7	72.8	93.2	92.5	21.9	81.9
DBAE63	84.2	39.9	96.1	95.5	94.2	96.3	80.7	77.0	97.9	77.9	71.8	98.4	90.9	21.9	87.3
DBAE71	90.5	52.4	97.3	98.2	95.9	98.5	78.8	77.5	95.2	85.5	70.0	85.2	94.1	12.7	81.9

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
DBAE72	87.1	47.9	96.6	98.1	95.3	98.0	78.5	74.9	96.8	83.0	74.7	88.4	92.4	18.7	84.3
DBAE73	84.4	43.6	96.6	98.0	95.4	97.8	79.8	75.9	97.2	78.1	74.9	95.6	91.4	22.8	82.9
DBAE81	87.2	47.4	97.9	95.8	96.2	97.6	81.7	89.0	95.7	85.7	68.4	88.5	93.8	19.4	78.4
DBAE82	84.5	43.4	97.0	95.6	95.3	96.9	81.1	83.6	97.4	83.2	72.7	91.9	92.0	22.7	82.5
DBAE83	82.4	40.3	95.7	95.5	93.9	96.1	79.5	77.7	98.5	81.4	68.1	93.0	92.2	21.2	87.5
DBAE91	86.7	50.0	97.2	98.2	95.9	98.3	78.3	77.4	95.7	85.6	69.6	84.7	93.7	14.0	82.2
DBAE92	84.3	47.5	96.5	98.1	95.1	97.8	78.5	74.7	97.3	82.9	74.6	86.5	92.0	19.0	84.8
DBAE93	82.1	43.5	96.4	98.0	95.1	97.6	79.6	75.6	97.3	78.6	75.1	94.8	90.8	22.8	83.5
EAAA21	94.4	69.2	99.3	82.1	97.6	92.9	98.3	92.6	88.7	87.6	63.5	83.8	97.5	27.5	70.4
EAAB21	94.6	68.5	99.1	83.8	97.8	93.6	93.5	90.9	88.9	87.6	63.2	83.9	97.1	26.2	71.2
EAAC21	93.8	69.5	98.9	83.5	97.4	93.3	90.9	89.7	89.2	89.8	64.1	82.5	96.5	27.3	72.2
EAAD21	93.7	59.0	98.9	86.6	97.0	94.6	90.0	88.9	89.9	91.3	62.7	82.5	96.5	26.8	72.7
EAAE21	94.4	58.6	98.4	86.1	96.2	94.1	83.1	81.5	89.5	90.9	64.3	79.3	96.1	27.8	77.3
EABB21	93.5	63.6	99.0	82.6	97.7	92.9	94.2	90.3	90.4	90.4	63.6	82.9	96.5	28.1	72.4
EABC21	93.4	58.9	98.9	85.9	96.3	94.2	92.9	89.6	91.3	91.4	61.7	82.6	96.8	27.6	73.2
EABD21	94.1	61.4	98.9	86.3	96.7	94.4	86.8	87.3	90.9	92.1	61.0	81.1	96.9	27.0	73.4
EABE21	95.7	55.7	98.7	86.7	97.7	94.6	82.3	83.4	90.3	92.5	59.6	78.5	95.7	29.8	76.0
EACC21	93.6	59.2	98.5	83.8	96.1	93.1	89.5	86.0	92.0	91.2	60.6	80.9	96.7	29.6	75.1
EACD21	95.7	77.4	98.7	84.9	96.4	93.9	83.2	82.6	92.5	92.2	63.9	81.0	96.3	28.1	76.7
EADD21	95.5	52.4	98.4	85.1	97.1	93.7	85.7	84.8	93.3	93.6	61.0	76.5	95.5	29.0	76.7
EBAA21	94.7	68.0	99.1	91.7	98.1	97.1	95.4	90.8	90.0	89.8	62.9	81.9	97.1	30.1	71.5
EBAB21	93.9	63.1	99.1	94.0	97.4	97.9	92.3	89.9	90.4	91.3	63.6	82.8	96.6	28.7	72.3
EBAC21	94.3	60.4	99.1	94.6	97.3	98.2	89.1	90.9	90.7	89.7	60.0	83.6	97.2	27.2	71.1
EBAD21	94.1	58.9	98.7	96.3	96.1	98.6	87.0	85.4	91.1	91.4	61.7	81.1	96.7	28.2	74.3
EBAE21	96.0	55.4	99.0	98.1	98.4	99.7	81.5	83.2	90.0	92.8	59.8	77.6	95.8	27.0	75.6
EBBB21	94.3	60.4	99.0	93.7	97.2	97.7	92.2	92.0	91.7	89.9	59.5	82.3	97.6	28.4	71.3
EBBC21	94.4	61.9	99.0	95.0	96.6	98.3	87.8	88.6	92.3	91.9	59.4	81.4	97.2	28.5	73.4
EBBD21	95.8	58.0	98.8	96.9	96.3	99.0	85.0	83.7	93.1	91.8	62.6	81.8	96.1	28.3	75.8
EBCC21	94.0	57.7	98.7	94.8	97.4	98.0	90.5	90.4	92.9	93.4	58.4	78.6	96.4	31.1	73.8
EBCD21	95.7	52.3	98.8	96.4	97.2	98.8	86.8	85.6	93.4	93.7	60.5	77.3	95.5	30.6	75.5
ECAA21	93.6	64.4	99.0	91.1	98.5	96.7	92.0	92.5	90.4	89.2	61.1	81.9	98.0	30.5	70.9
ECAB21	94.5	60.2	99.0	93.2	97.3	97.5	90.9	91.8	90.8	89.8	60.1	82.0	97.5	28.8	71.6
ECAC21	94.6	61.2	98.9	94.8	96.8	98.1	86.4	88.1	91.7	91.9	60.9	81.1	97.0	27.9	73.8
ECAD21	94.5	56.9	98.9	95.9	97.9	98.7	88.8	90.0	90.9	91.1	59.5	80.9	96.1	30.0	73.1
ECBB21	94.6	61.1	98.9	94.0	97.0	97.8	89.0	88.9	92.7	91.9	59.9	80.2	96.9	28.5	73.9
ECBC21	94.5	56.9	98.8	95.0	98.0	98.3	91.0	91.0	92.5	91.1	59.1	80.5	96.5	31.0	73.1
ECBD21	95.9	52.1	99.0	96.8	98.0	99.1	87.1	86.3	93.1	93.8	60.1	78.5	95.7	29.8	74.6
ECCC21	96.3	56.5	98.7	94.6	98.0	98.1	86.2	88.6	94.0	93.1	59.2	79.1	96.5	28.6	74.3
ECCD21	95.8	54.0	98.7	96.3	98.1	98.8	86.8	89.2	94.3	92.9	59.0	79.3	96.8	31.4	73.5
EDAA21	94.4	61.8	99.0	90.7	99.5	96.6	92.2	93.6	88.9	91.8	59.0	80.6	98.0	34.5	69.6
EDAB21	94.3	58.8	99.1	92.4	98.9	97.3	91.2	92.8	89.1	92.4	58.7	81.8	97.7	31.3	70.3

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
EDAC21	94.5	58.3	98.7	93.9	98.2	97.8	89.5	89.0	89.5	89.8	58.4	85.0	96.9	28.1	73.2
EDBB21	94.5	58.3	98.7	93.0	98.3	97.3	92.7	90.0	90.8	90.0	57.8	84.7	97.0	30.9	73.0
EDBC21	95.4	52.7	98.6	94.8	97.7	98.0	88.2	86.5	92.6	93.4	59.6	78.8	96.6	30.3	75.4
EDBD21	95.5	53.4	99.0	96.0	98.4	98.8	88.3	89.8	92.0	91.2	58.2	81.3	96.5	29.2	72.1
EDCC21	95.5	53.4	98.9	94.1	97.9	97.9	89.6	90.6	92.9	91.4	58.7	81.8	96.4	29.6	72.5
EBAE31	92.7	52.5	98.0	98.1	97.6	99.0	81.1	87.8	92.1	89.7	63.2	84.9	95.9	16.2	76.3
EBAE32	88.7	49.2	98.0	98.0	97.1	98.7	81.6	85.7	94.3	84.4	67.3	88.7	95.7	22.0	76.3
EBAE33	88.0	44.7	97.9	98.0	98.0	98.7	85.3	88.6	94.8	84.3	69.6	90.2	95.9	21.0	75.7
EBAE41	90.8	51.4	97.9	98.0	97.4	98.9	81.0	86.4	93.2	86.3	64.3	86.0	95.4	17.8	77.1
EBAE42	87.9	48.4	97.7	98.0	97.1	98.6	80.3	85.0	94.9	82.3	67.2	88.1	95.1	20.6	77.2
EBAE43	86.2	44.2	97.8	98.0	97.9	98.5	84.2	88.0	95.1	80.5	66.4	93.4	95.2	22.0	76.7
EBAE51	88.2	45.7	98.2	98.2	97.6	98.9	83.3	87.0	94.1	85.0	66.1	86.5	95.2	18.3	76.3
EBAE52	84.4	42.3	97.7	98.1	96.9	98.4	82.2	85.1	95.1	82.1	68.1	87.3	94.7	20.1	78.1
EBAE53	84.1	41.5	97.5	98.1	97.1	98.3	83.3	85.3	95.3	80.2	67.8	94.9	94.3	22.4	78.3
EBAE61	89.1	43.3	98.2	96.2	97.9	98.1	84.0	94.3	95.7	85.3	64.9	89.0	97.0	15.4	75.8
EBAE62	86.7	39.9	97.8	95.8	97.1	97.5	82.9	92.4	97.3	86.0	64.9	88.1	98.0	19.4	77.3
EBAE63	81.8	39.3	97.9	95.6	96.9	97.3	85.5	91.7	97.4	78.8	66.4	97.9	96.1	22.8	76.4
EBAE71	90.2	47.6	98.5	98.1	98.6	99.2	81.8	89.3	94.5	85.0	66.1	86.9	96.6	15.7	73.6
EBAE72	86.5	45.3	97.9	98.0	97.9	98.6	81.8	87.2	96.3	82.2	69.2	88.0	95.4	22.2	75.6
EBAE73	83.7	43.0	97.0	97.9	96.7	98.0	81.2	83.2	96.7	78.1	67.4	94.1	94.4	23.3	78.6
EBAE81	86.7	49.0	98.8	95.8	98.2	98.1	81.0	96.7	95.5	89.0	59.3	85.2	98.7	18.5	73.0
EBAE82	83.4	39.9	98.2	95.6	98.0	97.5	86.6	98.5	96.8	87.9	64.9	87.3	99.1	24.1	73.7
EBAE83	78.8	32.6	97.9	95.4	97.9	97.0	85.0	100.0	96.8	83.5	65.9	93.5	97.5	17.6	71.5
EBAE91	86.3	46.4	98.3	98.1	98.5	98.9	81.2	89.1	94.9	84.3	64.5	86.6	95.9	17.8	74.1
EBAE92	83.4	44.2	97.7	98.0	97.9	98.4	81.6	87.5	96.7	82.2	69.3	87.0	94.7	20.6	76.0
EBAE93	82.6	40.5	97.8	98.0	97.8	98.3	84.9	88.3	96.6	80.0	67.7	92.2	95.7	22.1	76.0
GAAA21	92.3	78.5	99.5	81.3	98.7	92.7	90.5	94.5	89.3	90.6	63.6	83.1	98.9	30.2	67.6
GAAB21	91.5	63.6	99.5	82.3	97.8	92.9	95.9	97.3	88.2	87.1	60.4	85.1	98.8	29.0	67.8
GAAC21	91.5	59.7	99.4	83.5	98.3	93.4	92.0	96.1	89.2	87.8	61.0	85.7	98.9	27.2	68.1
GAAD21	92.3	63.0	99.3	84.9	97.2	94.0	89.8	90.8	89.6	87.8	60.2	85.5	98.4	24.7	70.2
GAAE21	92.1	54.6	99.1	85.4	98.6	94.1	85.7	89.0	89.2	91.4	61.2	78.9	97.6	27.3	70.8
GABB21	93.1	60.1	99.3	81.9	99.6	92.8	95.7	99.4	89.5	88.1	59.4	82.5	99.8	28.3	65.3
GABC21	93.1	54.9	99.0	83.6	99.2	93.4	93.8	98.0	89.8	88.9	58.8	84.5	99.7	27.5	66.9
GABD21	93.2	55.1	98.9	84.6	99.1	93.7	89.6	95.1	90.9	89.0	58.5	85.1	98.9	26.3	68.5
GACC21	93.3	55.9	98.9	83.4	98.8	93.2	91.1	95.8	91.8	89.0	58.7	84.8	99.0	27.3	68.7
GACD21	93.9	56.3	98.8	84.0	98.6	93.4	88.4	91.3	91.8	88.4	59.9	86.0	97.8	27.4	70.8
GBAA21	91.6	61.4	99.4	91.1	98.9	96.7	100.0	99.1	89.1	89.2	60.3	83.5	99.1	33.3	66.7
GBAB21	91.6	63.4	99.4	93.1	99.9	97.7	94.2	99.5	90.0	88.3	58.3	83.4	99.9	26.9	65.2
GBAC21	91.6	58.5	99.3	94.0	99.6	98.0	92.7	97.9	90.3	88.9	58.5	84.8	99.5	26.6	66.8
GBAD21	91.8	58.5	99.1	95.8	99.4	98.7	88.5	95.0	91.1	89.2	59.6	85.5	98.5	25.7	68.3
GBBB21	93.3	55.0	99.3	92.9	99.6	97.6	95.7	98.3	91.1	89.3	58.5	83.5	99.4	27.8	66.6

Table A-4. Economic benefits and environmental resource values for 384 alternatives expressed as a percent of the maximum value averaged over a 21-year simulation period (1930-1950).

	Economic Benefits						Environmental Resources								
Alternative	Flood Control	Navigation	Hydropower	Water Supply	Recreation	Total	Young Fish Production	Coldwater Lake Habitat	River Fish Physical Habitat	Riparian Habitat	Warmwater River Habitat	Wetland Habitat	Coldwater River Habitat	Tern and Plover Nesting Habitat	Historic Properties
GBBC21	91.8	58.5	99.1	94.6	99.0	98.2	91.1	96.0	92.6	89.6	57.6	84.6	99.0	27.4	68.2
GBBD21	93.0	58.9	99.2	96.3	98.9	99.0	86.5	91.1	92.8	91.7	58.3	83.3	98.1	29.5	69.9
GBCC21	94.3	55.3	99.0	94.7	98.5	98.2	90.1	91.8	93.3	89.2	58.8	86.1	97.9	28.4	70.7
GCAA21	93.5	59.1	99.4	91.6	100.0	97.1	95.8	99.3	90.3	88.9	59.1	83.6	99.9	29.8	65.4
GCAB21	93.5	54.9	99.2	92.6	99.6	97.4	94.6	98.1	90.2	89.4	58.1	84.2	99.7	27.8	66.5
GCAC21	94.7	54.9	99.1	94.4	99.4	98.2	90.0	95.1	91.5	91.6	59.5	82.6	99.5	26.3	68.3
GCAD21	93.4	54.9	99.0	96.0	98.9	98.8	87.6	91.8	91.6	89.0	59.6	85.9	97.9	24.8	69.8
GCBB21	94.7	54.9	99.1	93.4	99.2	97.7	93.1	95.9	92.7	91.6	58.8	81.7	99.6	27.5	68.2
GDAA21	94.3	58.8	99.1	90.5	99.9	96.5	95.0	98.4	89.0	89.4	59.3	84.9	100.0	30.7	65.9
EVQ2	0.0	-24.6	94.3	87.0	99.6	87.7	81.1	97.6	94.3	66.0	82.3	100.0	87.7	100.0	70.1
POWER3	80.7	42.4	100.0	95.1	93.1	97.8	84.1	82.1	94.7	78.9	94.1	78.2	92.2	36.0	63.9